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THE MEDICAL INSPECTION OF SCHOOL CHILDREN.

THE MEDICAL INSPECTION OF SCHOOL CHILDREN:

A TEXT-BOOK FOR MEDICAL OFFICERS OF SCHOOLS,
MEDICAL OFFICERS OF HEALTH,
SCHOOL MANAGERS AND TEACHERS.

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EDINBURGH AND GLASGOW:
WILLIAM HODGE & COMPANY.
1904.

DEDICATED BY PERMISSION

TO

SIR HENRY CRAIK, K.C.B., LL.D.,

SCOTTISH EDUCATION DEPARTMENT.

PREFACE.

The Report of the recent Royal Commission on Physical Training (Scotland) contains a definite recommendation that "provision be made for regular medical inspection of the children in all schools." In the present volume, an attempt is made to give form and substance to this recommendation. It is obvious that before such regular medical inspection can become a reality, the school manager, the teacher, and the medical inspector must be brought into definite relation. To do this necessitates a detailed study of the administrative organisations, the routine of school teaching, and the limits of useful and practical medical inspection. Accordingly, this book has been specially devised to assist the school administration to organise, the teachers to train themselves in preliminary inspection, and the medical inspectors to economise time and energy.

Professor Matthew Hay, to whose fertility of design and method the Edinburgh and Aberdeen investigations owed so much, has been kind enough to prepare for this volume full descriptions and illustrations of the special anthropometrical appliances devised by him. His many other contributions to the substance of the book are acknowledged in the appropriate places.

Dr. Edwin Matthew, who acted as chief assistant in the Edinburgh investigation, drafted the chapters on the Eye, the Heart, the Circulation, and the Skin; he furnished materials for the sections on Lungs, Nervous Diseases, Adenoids, and Tonsils, and I have, in all the clinical chapters, had the advantage of his special knowledge and experience.

I have to thank the Royal Society of Edinburgh for permission to use the blocks of Dr. Hepburn's Craniometer Callipers; the Council of the British Association and Dr. Garson for permission to reproduce two plates from Garson

and Read's "Notes and Queries on Anthropology"; Messrs. Curry & Paxton for copies of Snellen's Test Types; Messrs. Avery for permission to reproduce the illustration of their attachable height measure; Mr. Gray, B.Sc., for photographs and descriptions of his anthropometrical instruments.

The index has been prepared with great care and elaboration by Mr. A. J. Bain, Public Health Department, Local Government Board for Scotland.

To Professor J. Arthur Thomson and his writings I am indebted for many references and fruitful suggestions. The other sources of information are acknowledged in the text.

To R. B. Pearson, Esq., Advocate, Secretary of the Royal Commission on Physical Training (Scotland), I owe thanks for his discussions of many practical points emerging from the Commission's Report.

In the administrative sections, I had the inestimable advantage of discussion with J. Burn Russell, Esq., M.D., LL.D., member of the Local Government Board for Scotland.

I wish to add that the book really owes its origin to the medical member of the Commission—Professor Alexander Ogston, M.D., LL.D., Surgeon in Ordinary to His Majesty the King in Scotland. For Professor Ogston's cordial encouragement over many years I now take occasion to record my thanks.

W. L. M.

EDINBURGH, *April*, 1904.

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PART I.

THE OBJECT, FORM, AND ORGANISATION OF MEDICAL INSPECTION.

CHAPTER I.

The General Case for a Medical Inspection of State School Children.

1. *Existing Systems of Medical Inspection.*

For many years medical officers of health, medical officers of schools, medical practitioners, and many others concerned in the organisation of schools have, from time to time, suggested the desirability of instituting a medical inspection of schools. Methods of realising such an inspection have been as various as the conditions that originated the suggestion; but on one central point all are agreed, namely, that the time has come when children, subjected as they are at school not only to the infinitude of risks associated with infectious disease, but also to the increased stress of life involved in the concentration of nervous effort on school work, should receive at the hands of the authorities responsible for them the detailed medical supervision that only a system of medical inspection can offer. Already, in many places, the school boards, the school trusts, the school organisations generally, both private and public, have arranged a medical inspection of schools and scholars. In England the system has so far spread that already there is a Society of Medical Officers for Schools; the larger school boards provide for medical attendance on their teachers and pupil teachers, for the regular visiting of their schools, for the dovetailing of medical school inspections with the regular work of the public health organisations, and, generally, for the discovery of infection among school children and the

prevention of infection by detailed periodic examinations of school premises. In many public schools, more especially where a boarding system is in force, medical inspection has gone much further. Such schools retain the services of a medical officer, whose duty it is to examine all pupils admitted, to ascertain their fitness both for the mental work of the school and for the physical training required, to attend any cases of illness that may arise, to arrange for the isolation of infectious diseases either within premises provided by the school or in the hospitals of the local authorities, and to report, from time to time, to the governors any circumstances that may imperil the hygienic safety of the children. In the industrial schools, too, which are under the control of the Home Office, the managers appoint a medical officer whose duty it is to attend any cases of sickness and to exercise a general supervision over the health of the school children. In many other schools, even where medical practitioners are not retained, it has become the custom systematically to measure, weigh, and examine all the pupils admitted and, from time to time, all pupils in attendance. Since Herbert Spencer wrote his "Education," over fifty years ago, attention has been again and again directed to the necessity for maintaining the health of children at schools if the intellectual work required of them is to be successfully achieved. Books such as Carpenter's "Principles and Practice of School Hygiene" and Dr. Arthur Newsholme's "School Hygiene," have not only focussed medical ideas and practical methods, but have also succeeded in diffusing them among the general school public. The fear of infection has, it is true, played an enormous, perhaps an exaggerated, part in the minds of lay school managers; but probably just because of the exaggeration, the trouble due to infection of schools has become steadily less. But infection, important as its persuasive effect has been, has not stood alone among the instruments of persuasion. More than a generation ago, the public schools awakened to the necessity for "a sound mind in a sound body." Perhaps they have interpreted this much-abused half-line

of Juvenal * more to justify their methods of producing a sound body than to stimulate the manifestation of a sound mind; but the instinct, the sense for balance in education, was beyond doubt founded in good mental physiology. Perhaps, too, the devotion to physical exercise so prominent in the last twenty years has time and again resulted in irreparable damage of individuals; the effort to keep the body sound has occasionally resulted in the starvation of the mind and, not infrequently, in the impairment of the physical powers themselves. Nor this only. The evil results, such as they are, of excessive physical exercise have in great part been due to the want of detailed medical supervision. The conviction that this is so has, as we have said, operated to increase and improve the amount of medical inspection of schools and scholars.

2. *Medical Inspection in State Schools.*

As by its spontaneous growth, medical inspection has already made for itself a place in the great voluntary school organisations, there is no need to argue further in its favour. It is different with the State schools. Here an entirely new principle emerges. To the great public schools of England and Scotland, to private schools of every grade and variety, and to all voluntary education institutions generally, pupils are sent on the terms prescribed by the governors or arranged with the pupils' guardians. To the industrial and reformatory schools, which are provided only for a selected population and are managed under special Acts of Parliament, pupils are sent by the magistrates and on the terms prescribed by the statutes. In both of these classes of school—the one absolutely voluntary, the other absolutely compulsory—the governors are responsible for the health of the children. But in the State schools it is not precisely so.†

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* Satire, x. l. 356.

† Formerly it was so in France. (See evidence of Mr. C. Brereton, R.C. Phys. Train. (Scot.) Report, II., p. 400.)

As a type of a State school, we take any of the schools under the management of the school boards in Scotland. Before long, it may be, the school boards will be re-organised into a larger administrative system; but this will not affect the principle of State education. This principle, broadly put, is that all children between the ages of five and fourteen must be educated according to the methods prescribed in the Scotch Education Code. This is otherwise named "compulsory education." Let us examine briefly the meaning of it and the deductions that may be made from it.

3. *Primary Assumption of State Education.*

When, some thirty years ago, it was enacted that all children of school age in Scotland should be educated, one assumption was made—that the parents or guardians were capable of keeping their children in a fit state to receive the education specified. This assumption, though, so far as we are aware, not anywhere explicitly set forth, was, on the whole, justified. For several generations, the parish schools of Scotland had been educational centres of the highest potency. The parish school not only educated the children, it succeeded also in educating the community. No child of a parish needed lack for education. Naturally the people in general came to believe in education. The value placed upon it in Scotland has become a common-place of the political platforms. The schools maintained by the ecclesiastical organisations of forty and fifty years ago succeeded in gathering in without compulsion a large percentage of educable children. A large percentage, doubtless, still remained without. But when education was made compulsory by law, the new school boards found themselves doing what had been done with varying degrees of efficiency for several generations. They set themselves to gather in the remnant. They appointed officers to discover absentees and the reason for their absence. Nor only this. They instituted fees, or increased the fees already chargeable. By the regulations of the Education Department, they were placed under

obligation to see that every child of school age attended for so many school days in each particular year. If the child failed to complete the prescribed attendances, the board suffered by loss of grant and incurred the risk of the unpopularity necessarily associated with increase of rates. It followed that the stringency of administration became greater than in the earlier years. The expense of school attendance became greater. Parents that, from ignorance, or indifference, or economic causes, had formerly failed to have their children educated were now obliged to fall into line with the others. Attendances increased. School work increased. School subjects increased. In general, it may be said, with truth, that the whole conditions of education imposed a heavier burden on the parents and guardians both directly and indirectly —directly, in universally requiring school attendances and fees; indirectly, in requiring the provision of increased school accommodation and increased staff.

Yet, on the whole, the general public responded well to these requirements. If in individual cases poverty was too great, provision was made for relief of fees. Later, fees in the vast majority of schools were abolished. Meanwhile, the parents and guardians had become accustomed to the increased obligations placed upon them—the obligation of compulsory education and the obligation to pay fees. The obligation of compulsory education carried with it the further obligation to keep the children in fit health for school attendance. This obligation remains; the obligation to pay fees has lapsed. But it is to be noted that the remaining obligation of compulsory attendance, involving the maintenance of health and fitness of the children, is a distinct addition to the burdens that parents had to bear before the days of school boards. Yet, on the whole, in Scotland at least, this burden is well borne; the sacrifice of possible wages earned by children of school age, the expense of keeping in health and clothing the children attending school, and the parental duties incidental to these obligations have not acted in any striking degree, if at all, to reduce the numbers educated. The

economic gain of good education is universally accepted as justification in full for the temporary sacrifices.

In Scotland, therefore, the primary assumption at the basis of compulsory education, namely, that the parents are able to maintain the children in a state of physical fitness for school attendance, had good foundation in experience. The relief of fees is certainly a diminution of the burden; but the maintenance of a child in fit health for school attendance for nine years—from the age of five to the age of fourteen—is no trivial burden in itself, and the relief of fees at once lessens the parents' temptation to keep the child from school and justifies the State in using stronger measures to enforce attendance.

Nearly two generations ago Mr. Herbert Spencer, in "Social Statics," argued with his usual lucidity against the whole system of State education by school boards. He declared, with a logic more convincing before the fact than after it, that if the State undertook to educate the children, it must also undertake to feed them, to clothe them, and to tend them in sickness. If we were discussing abstract questions of social polity, it would be interesting to examine in detail Mr. Spencer's contentions. His argument still constitutes a wholesome criticism of extreme doctrines in State management. For the present, however, we are concerned solely with the concrete question as it emerges at the moment. How does the question stand now?

4. *Pre-suppositions of Compelled Attendance.*

Compulsion in education pre-supposes two things—first, that the child is mentally and physically fit to be educated; second, that after his State education is completed, he is capable of remaining fit for the duties of civil life.

First—Fitness for Education.

(a) *Mental.*—The Scotch Education Code provides for the classification of children into fit and defective. But "defective" does not cover precisely the same

ground as mental unfitness. As is shown in detail later, the declaration of defect is based on a medical examination. But with the general question of mental fitness or unfitness, apart from gross defectiveness, the Code does not deal, nor does it offer any criteria for the guidance of teachers or parents. As a fact, however, the necessities of school management have resulted in a rough classification of children according to mental capacity. In some places, special arrangements are made for feeble-minded children. Imbeciles, idiots, epileptics, &c., are, through the Code or otherwise, provided for. The industrial schools form a convenient outlet for some children not suited to the regular work of the ordinary school. The day industrial schools provide for yet another abnormal type. It remains true, however, that many dull or feeble-minded children are sent to school under compulsion. The responsibility of the parent is thus discharged; but the pre-supposition of mental fitness is practically disregarded.

Voluntary effort has already led the way in the remedy of this great difficulty. The admirable work of Miss Mary Dendy in the Manchester schools shows at once how great are the numbers of the mentally feeble, and how easily applicable are the methods of elimination from school. The greater problem—segregation after school age—is not here in question. (See paper by Miss Dendy, British Association Report for 1901.)

In Scotland, however, the school organisation, as we shall see, is not entirely helpless. It may reasonably be hoped that, as medical inspection becomes organised, the numbers of the mentally deficient will be more systematically and, therefore, more accurately ascertained, and the methods of educating them more scientifically developed.

(b) *Physical.*—The pre-supposition of physical fitness we have seen to be, in Scotland at least, on the whole justified. But this statement has important limitations. The standard of physical fitness justifying compulsory attendance at school is one thing; the standard that shall ensure the greatest benefit to the child is another thing. It may at once be granted that the first rough standard

has been sufficiently realised to justify compulsion; it will, in the subsequent chapters of this book, be abundantly shown that the second standard has not been even approximately realised. It is this fact that gives to every serious proposal of medical inspection its extreme cogency.

Second—Fitness for Civil Life.

It is necessary to ensure that the child shall be fit to attend school, to profit by the education offered, and not to suffer in after life. This proposition is as important as the first. It might be put thus—the school education must not hinder, it must help, the development of the adult. To secure this, some form of child inspection is essential. If it be the case that the ranks of the mentally and physically inefficient among adults are largely, if not chiefly, recruited from those that have had a bad start in life, the case for a scrutiny of the child and his conditions of living is overwhelmingly urgent. The inspection of children at school will not solve all the difficulties; it cannot cover the whole ground; it cannot secure to all a better start; but at least it will reveal some of the preventable causes of inefficiency in some of the cases. It will, at all events, be a better guide than haphazard in the choice of remedial measures. It will add to the information we may already obtain from the survival into adult life of children enfeebled from the first by neglected ailments that had been made even more disabling by the strain of school. Some of these ailments are preventable at an early age and cease to be preventable when growth is advanced. It follows that school is the proper place to waylay the child for examination. It is the best place for the preliminary medical inspection.

5. *Corroborative Evidence.*

In the report on 600 Edinburgh children examined for the Royal Commission on Physical Training, it is stated as one of the conclusions—" That the large number of serious and minor diseases directly and indirectly affecting physical efficiency and mental

efficiency constitutes an overwhelming case for a medical inspection of school children"—(Royal Commission on Physical Training Scot. Rep., page 100.) This is a comprehensive and very strong statement. It is made as the result of some forty thousand observations, great and small. With these in detail we are not for the moment concerned, since they form a substantial part of the chapters following. On the general principles, however, implied in this conclusion, we should like to make some observations.

(a) *Discovery of Defects.*—In asserting that the presence of serious and minor diseases justifies the medical inspection of children, the report assumes that such diseases cannot be discovered except by a medical expert. The truth of this assumption will be doubted only by those whose prejudices are very strong or whose ignorance is very great. The details revealed by the Edinburgh report, by the Aberdeen report, and by the other masses of facts and figures brought together in the report of the Royal Commission, make it clear that medical knowledge applied is essential to the discovery of a multitude of minor and major defects. The teacher settles the matter in the only way open to him—he sets the child to work and his defects are soon revealed. If, from some defect of vision or hearing, the child fails to keep in the advancing line, the teacher classifies him according to capacity. He soon discovers whether the child is healthy or unhealthy, because he finds that absences begin to accumulate. Frequently, acute illness is so marked that no teacher of discrimination has any difficulty in discovering it. But the teacher cannot be expected, in general, to discover any defects or ailments other than those directly interfering with school progress, and as the school organisations afford means for separating the clever from the dull, the dull from the defective, and the defective from the imbeciles, the discovery of defects ceases to have for the teacher any overwhelming importance. He is concerned primarily to teach such minds as are placed under his direction; he is not required also to create the minds to be educated.

"Sir," said Dr. Johnson once, "I have given you reasons; I cannot give you understanding." Unless, therefore, the teacher happens to have special skill or special interest, he makes it his concern to educate each child within the limits applicable to his faculties. If, however, he is concerned that each section of the school and every child in the section shall advance at the best pace, he does well to search out defects of eye, of ear, of throat, and such other organs as are easily inspected. But no teacher can reasonably be expected to do all this work in detail. The aspcct of the face, the posture of the body, the blinking and peering of the eyes, the turning of the head to listen, the perpetually open mouth, the presence of squints, thinness, pallor, lameness—these and such as thesc are outward signs that convey some information even to the ordinary observer with a modcrate knowledge of physiology. But none of these avails much in the detection of heart disease, of incipient lung diseases, definite ear defects, definite eye defects, or many other conditions that impair school efficiency. The tcacher, as the details of subsequcnt chaptcrs will show, can afford to the medical inspector a vast amount of useful information; but he cannot properly be required to do work that can bc done only by skilled mcdical mcn. The only practical method of ascertaining the amount and seriousness of disease in a school is systematic inspection by skilled men acting according to a definite programme.

Here let it be said that a slipshod and superficial examination, such as might suit for certain occupations, is not enough. Examination must be a full, detailed medical examination of the senses and vital organs; it must be done in view of the fact that the child will for so many hours in so many days for so many years be subjected to an ever-renewed strain on the nervous system. He must be fit to profit by the extended discipline incident to school life. At the end of the school life he must be fit to pass under the greater stress and strain of social life. In the interval he must acquire knowledge without losing elasticity of mind; he must increase in brain with-

out wasting in body; he must maintain the physical equilibrium essential to the highest organisation of character. Conducted with these large issues fully realised, the medical examination of children emerges as an essential and primary condition of their successful education.

(b) *Possibility of Remedy.*—In the Report it is further assumed that, once ascertained, the diseases among school children can be effectually dealt with. This is an entirely different question. The Royal Commission on Physical Training set out with the primary object of discovering what facilities existed in Scotland for physical training, what physical training systems were actually in use, and under what conditions physical training could profitably be extended in schools. In the carrying out of these objects, the Commission took measures to discover not only the conditions that favoured, but also the conditions that hindered, physical culture. They instituted an examination of 1200 children in Scotland. As the result of the investigation, they were satisfied that a pre-condition of the successful extension of physical training was a discovery of defects and diseases among school children. It was assumed that medical inspection would be so organised as to result in the definite elimination of the physically unfit or in the provision for them of exercises suitable to their state. The Commission made suggestions, which will be considered in detail later, for the organisation of a medical inspection. We shall show that already a great deal can be done under the existing law to further the objects of the Commission; but it must at once be conceded that neither the present legal powers nor the present organisations are entirely adequate to the new work proposed. It is for the reader to judge whether the case here made out and the methods here set forth are not enough to show that medical inspection of schools is a first and effective step to the rectifying of physical defects of sense and body; to the preventing of much that is preventable and the mitigation during school life of many conditions capable of mitigation. The masses of evidence placed

before the Commission and the judgment they finally arrived at can leave little doubt on the reflective mind that a medical inspection of school children is not only directly and indirectly beneficial, but is also overwhelmingly necessary. We are losing the good material of our nation because we are forcing defective organisms into work that spoils them for life or prevents their issuing in their best. It is the duty of the State, which imposes the burden, at least to ascertain the conditions that make the burden tolerable. Once ascertained, these conditions will be removed, or, at least, the way to their removal will become clearer. What can be done for each class of disease will become manifest in the course of the exposition. Meanwhile we content ourselves with the general statement that the work of the Commission, as a whole, the details of the particular examinations in Edinburgh, Aberdeen, and elsewhere, the large masses of facts thrown into order by the Report, the opinions of many experts in education, in training, and in medicine, all converge on the double conclusion that the time has come for adding to the ordinary inspections a medical inspection of schools and school children, and that a medical inspection may be relied upon to reveal defects, and to direct the remedy of an appreciable amount of the defects revealed.

6. *Administrative Difficulties.*

(a) *Parental Objections.*—When a system of medical inspection is once fully organised, difficulties at present in the way will cease to exist. Perhaps the primary difficulty from the administrative standpoint is the objection of the parent to the examination of his child. This objection is to a certain extent reasonable and natural. In the Edinburgh investigation, it did not appear to any appreciable extent. In Aberdeen, it did appear and made the particular investigation somewhat more complicated and difficult. How far it affected the results of the limited selection of children it would be impossible to estimate with exactitude. In any case, parental objection cannot have the same importance when

the inspection is done with definite administrative action in view as when it is done for the purpose of a special inquiry.

At the same time, the order of objection made gives a hint of what the administrations may expect. In the course of the Edinburgh investigation, some of the parents indicated that, though not objecting to the examination at the particular time, they considered it entirely superfluous; that, if there was any suspicion of ailments affecting their children, the family doctor would be asked to examine, and that they habitually paid attention to the medical as to the other needs of their children. It was explained that the object of the special investigation was primarily to ascertain the proportion of defects, or illnesses, or diseases, and that, from this standpoint, a healthy child counted for as much as a diseased child. With parents that habitually give to their children the attention here implied, probably medical inspection is as a rule superfluous. Yet even here, it is not so much the gross as the hidden danger that justifies examination. The dangerously enfeebled organ that no doctor is ever asked to treat, the slightly enlarged gland that is preparing the way for tubercle, the slightly consolidated lung that in a few months will pass into acute phthisis, the slight recurrent cough that points to feebleness of mucous membranes, the slight "pigeon" chest that points to respiratory insufficiency, the slight deafness that tells of chronically inflamed tonsils, the slightly open mouth that tells of obstructed nasal passages, the turn of head that follows on perforated ear-drum or astigmatic eye, the resting of one foot on another that presages hip-joint disease, the clubbed fingers, the cold hands, the blue cheeks that all hint of bad circulation—these and the infinite variations of these and others do not normally attract the attention even of careful parents, and they are seldom if ever made the occasion for calling in a doctor. Why should a doctor be needed for a cold in the head? Is not a swollen gland a common enough thing? The child's cough is only a "slight cold." "He often turns his head that

way when he reads or writes—a habit he has got into. He never saw very well. He was always pale." And so on. Most of the neglect typified by the popular acceptance of minor ailments will be seriously reduced, if not entirely dissipated, by medical inspection of the child at school.

Even in the present state of the law these parental objections are not serious in amount. In any given hundred parents, there will be found "conscientious objectors," be the cause never so reasonable and the method never so delicate. But they will decrease in number as they increase in knowledge. They cannot be legislated for. As a rule, frank explanation dissipates objections. The interference with the child, male or female, amounts to very little. In careless hands, however, the exposure for examination of chest might be needlessly great. A medical inspector must not merge the human in the medical. If he has no sympathy with child-life, if he does not know how to preserve from insult the tender shame of the adolescent, or the nice habits of the well-bred infant, he will get his lesson sharply from some sensitive mother, or some keen-tempered father, or some experienced teacher. Above all things, he must learn to avoid bullying or scolding if he wishes to forestall the objections of parents. Nothing is fuller of charm than the response of the natural infant to sympathetic handling; nothing less lovely than his shrinking from the bully, and the hectoring person. If we are to get the most out of medical inspection of schools, if we are to carry the children and, therefore, the parents with us, we must study them as we should study the shy wild animals, neither bullying nor scaring, getting into confidential relations with them, filling their minds with the importance of a healthy life, catching their secret from the "shooting lights" of their "wild eyes."

Parental objection will, of course, cease to be relevant if the law for general diseases should be amended into line with the present law for infectious diseases. It is well, however, that the parent whose child is in question should give the cordial assent that makes legal assertion

unnecessary. With a little experience, he will learn to appreciate the value of finding out the weaknesses of his children. He will be grateful to be put in a position to guide his child towards health. He will find, as he has found with the infections, that it is economy to know the worst at once. The careful parent, who alone is likely to trouble the inspector, is also likely to have the least unhealthy children, or at least he is the likeliest to know of their ailments in advance and to provide for them. The careless parent, on the other hand, will not trouble much about an extra necessity that does not interrupt his personal work. He will accept medical examination as readily as he does most other slight alterations in the routine of his environment.

(b) *Parental Responsibility.*—The cases recorded in the Edinburgh and Aberdeen reports are not imaginary; they are not mere forecasts of probabilities; they are instances of conditions actually found in the course of a partial medical inspection of actual schools worked within the ordinary conditions of schools in Scotland. In view of such facts as these, can the need for medical inspection be any longer doubted? It cannot from any standpoint be right to permit the preventable causes of school and social inefficiency to work their full record of evil. On the other hand, it cannot be wrong to take measures of prevention at the stage of life when measures are possible and when they may have some effective result. If it be said that this relieves too much the responsibility of the parent by transferring to the State the duty he should himself perform, the reply is twofold. The medical inspection at school will, as it has already to a less extent done with infection, stimulate the parent to consult his medical attendant more frequently, to revise his standard of conditions needing the attention of the surgeon and the physician, to pay to his child's health the same detailed attention that his own feelings and his own necessities make urgent for himself, to study more intimately the delicacy of the growing organism and generally to enlighten his mind on the enormous economic import-

ance of the early treatment of disease-tendencies. His responsibility, therefore, for the health conditions of the child is made more extensive and more stringent. The medical inspection at school relieves him from nothing; it rather extends his duties. It reveals to him defects that in the ordinary routine of living he would not ascertain himself. It confers at once a service and an obligation.

All this applies to the careful and efficient parent. The other order of parent will also be affected; but how he shall best be dealt with raises problems that as yet admit of no final solution. His feelings of responsibility have hitherto led him to neglect his child. If the State finds it important to step in where the parent has failed, the child at least benefits, but the parent should not be allowed to pass out of the reckoning. Among the children examined at North Canongate School were some that came there in a state of criminal neglect. It was beyond expression sad to note the pinched faces, the uncleaned bodies, the verminous clothing, the uncombed hair, the pallor, the feebleness, the unchildlike want of spontaneity that in every movement spoke of the heedless parent and the crowded home. It cannot be right to compel these to attend school and wrong to make it possible for them to learn. It cannot be right to force their brains and wrong to refect their bodies. It cannot at one and the same time be right to compel the education of children and to perpetuate disease-conditions. It cannot be right to attempt the education of eye and ear when these are already known to be defective. It is absurd, even from the educational standpoint, which is the primary concern of the State organisations, to work these defective organs, the chief feeders of the brain, as if their defects were indifferent. If a child is backward from defective vision, the remedy is to rectify the defect. If he falls behind because his ear-drum is perforated, he should at least be examined that his progress shall not grow slower. If the brain is inactive from defective circulation, it is at least worth ascertaining whether the cause be want of food or congenital heart disease, or

bad home conditions, or the supervening of some acute disease or of unhealthy conditions that will end in acute disease. Such a child cannot properly be placed with other healthy children of his own age, for he will suffer, and that cannot be for the good of him or of others. If the Code is not elastic enough to give the teacher discretion to deal with such cases, then it must be amended to the necessary elasticity. Once more, if a child is suffering from chronic bronchitis, he cannot without detriment be exercised in the room suitable to others or take part in the same strains. When we come to diseases like phthisis, there is only one thing to be said—the system that makes it possible for any child suffering from acute phthisis to be at school with other children in the conditions ordinarily realised at school demands instant reform, and one factor in the reform is the access of the medical inspector. If a child is suffering from contagious skin disease, it is illegitimate to place him with others not so affected.

Some of the morbid conditions may be discovered by simple observation, but the majority of them cannot. The investigation necessary for their discovery is normally the work of medical men. If, then, any of the conditions indicated are found to prevail to any considerable extent in schools of any class, the argument for a medical inspection grows in convincing effect. From the child's point of view, the obligation to make the most of him, to grow him into his best, cannot be gainsaid. From the parents' point of view, there is a danger of lapsed responsibility. It is for the larger statesmanship to say how the obligation to the child shall be fulfilled and the responsibility of the parent maintained.

7. *Points of Urgency.*

(a) *School-stress in the Normal Child.*—As the details given later will show, the amount of serious and obvious disease in any given school is likely to be considerable. In the poorer schools, this becomes manifest through increasingly bad attendance. The illnesses increase with the increase of stress. The feebleness of constitution may

remain hidden so long as there is no continuous routine in front of the infant; it at once asserts itself when the steady daily system of the school enters as a factor into his life. The first day is all novelty, the second is play, the third is routine, the fourth is duty. And duty is stress. The child that came and went as he listed before, comes now at the time appointed. He no longer takes his sensations for guide; he must answer to an impersonal system. He must be fed, he must be washed, he must be clothed for school. He must learn something systematic. He takes the new environment and incorporates it with the old. The irregularity of the street or open country life is displaced by the system of school routine. Relatively, this is work, and the good constitution thrives under it; the bad breaks down. Hence at an early stage of school life marked unfitness for school asserts itself unmistakably. The child grows thin, nervous, restless, sleepless. Whatever weakness of heart or lung, gland or alimentary system he inclines to, will grow obvious. He is found unsatisfactory by the teacher; he is an increased trouble to the parent. Perhaps he catches some of the school diseases—scarlet fever, or measles, or whooping-cough, or diphtheria. These take most readily those most ready to take them. So generally.

(b) *School-stress in Unsuspected Disease.*—These manifestations of constitutional feebleness or vulnerability prepare the way for the elimination of some of the unfit. But others are born with defects, such as certain heart ailments, that do not appreciably affect the early years, yet may make an enormous difference to the later. Illustrations of these are found in subsequent chapters. Or, without any early sign, the beginnings of tubercle may be laid. Perhaps some acute illness like measles supervenes and tubercular conditions manifest themselves nominally as a sequel, really as an acute outcrop of a previous condition. For instance, a child has been known to take diphtheria in a most virulent form, and die. The post-mortem examination showed innumerable patches of unsuspected tuberculosis, tubercular glands and abscesses

in chest and abdomen. In other cases, careless upbringing may encourage wrong habits of breathing. Nutrition may suffer. The load, at first easily borne, increases faster than the strength to bear it. But these conditions may proceed for months and years and give no obvious gross sign. A day comes when the child breaks down with apparent suddenness. The doctor is called in. School life is suspended. The illness may be attributed to overpressure. Perhaps this is right, but the modification of the pressure at an earlier stage might have resulted in the better adaptation of the school strain to the organic conditions, and thus time and life might have been economised.

As we have already said, the hidden conditions and predispositions of disease constitute even a stronger reason for medical inspection all through school life than the gross illnesses that are patent even to the most careless parent. The minute study of the defects of sense confirm this conclusion. And every medical officer of health knows the paramount value of examining throats and noses when scarlet fever or diphtheria or a combination of them happens to be epidemic among a community.

(c) *School-stress in Defined Disease.*—The presence of defined disease is usually enough to persuade the parent or the teacher that a child needs medical attention. The presence of sensory or muscular defects is not usually accounted so serious. But a little reflection shows that the presence of a defect such as marked astigmatism, or hypermetropia, may have issues more grave to a child than the presence of enlarged tonsils or adenoid growths in the nose or pharynx. To begin with, the child is certain to suffer in the rate of his school progress. What he cannot see well impresses him less. What he cannot hear well leaves him with less accurate memories. What he cannot do well in movement leaves him a stage behind the more fit. And so generally. If the defect be a serious defect of vision, the consequences do not end with immediate incapacity. The child may suffer in his general health. The nervous strain of forcing the use of defective eyes may

produce headaches, nervous exhaustions, neurasthenia, enfeebled nutrition, and, indirectly, general "break-down." If the intelligence is good, the effort to keep pace with the normal child results in over-pressure, or wrong pressure. But of these effects none may be immediately obvious. They may be manifested as the months and years go past, now one rising into importance, now another. They all spring from a single root, they all tend towards reduction of efficiency, but they are all preventable if the defect is corrected at the right stage. This cannot be said of every sense defect, but the number of which it can be said is so large that it would alone justify a medical inspection of school children.

When one looks carefully into the admission register of a large poorhouse, one cannot help feeling that at least some of the diseases resulting in disablement and pauperism have had their foundations laid in the period between birth and the end of school life. With chronic diseases like phthisis, which often begins with glandular troubles, it is reasonable to assume that some patients either contracted the disease at school or might, by timely intervention at school age, have had the disease arrested. That a similar assumption is not possible with many other diseases may be due to the absence of systematic investigation. The gross cases of enfeeblement emerge frequently in the course of ordinary school life, or in the period immediately following school. But the incipient cases lie hidden until the stresses of adult life, the increase of labour, the exactions of adolescence, and the failure of nutrition reveal them to the inspector of the poor. There are no definite data on this important question; but a study of the facts adduced in such works as Mr. Rowntree's "Poverty," and the reports of the great parish councils like Glasgow, leads one to the conclusion that an earlier handling of the younger inmates of poorhouses might have reduced their numbers.

(d) *Danger of Disablement.*—So far the production of inefficiency. There is also the danger of disablement. Education is not exhausted by the education of the senses.

The muscular system and the viscera must be reckoned with. Even if for the moment physical culture in and for itself be disregarded, the defective child suffers more from accident than the normal child. The complications of school life, the rough-and-tumble of the playground, the spontaneous and inevitable contests of the infantile barbarian, all expose him to greater dangers. If he can compensate for his defect by developing greater faculty in another direction, he may score victories that are the envy of his fellows. But the rule is more likely to be that at least the early race is to the physically strong. One has only to watch the display of energy in any school playground to learn that the feeble spine or the tubercular bone will not wait long for its test. But a medical inspection would ensure that the test was applied, not by the chance actions of the playground or the street, but by the hands of men that can estimate its significance and direct the preventive measures.

(e) *Physical Culture.*—So far we have been thinking only of the examination necessary to secure that the child is fitted for the ordinary intellectual work imposed on him at school. When the question of physical culture proper arises, the necessity for a preliminary medical examination passes into the highest grade of urgency. It may be stated broadly that no physical culture of any kind should be enforced at school until the child is found and certified fit to undergo it without risk of immediate or remote injury. At first sight, physical culture itself seems to be really only a set-off to the intellectual work. This is a misleading and inaccurate view. Any form of physical culture that can be of service for discipline involves some exhausting labour. Nor that only. Physical culture, even of the gentlest kind, pre-supposes organs that shall not be injured by exercise. And their condition can be ascertained only by the most careful examination. When we come to the discussion of heart and lung diseases, we shall show that the facts discovered in four schools in Edinburgh, not to speak of the facts in the six schools detailed in the Aberdeen report, are alone sufficient

to indicate that the amount of serious heart and lung affections justifies the most exhaustive methods of discovering them. In these cases there can be no possibility of questioning that a pre-condition of successful education either of the brain or of the muscles is a precise adjustment of exercise to the imperfections of the particular organs and organisms. It is not enough that a child should appear fit; it is essential that he shall be known to be so. It is not enough that the teacher should be satisfied of his nerve and muscle; it is equally essential that the doctor should be satisfied of his sound heart and lungs. Neither on grounds of general education nor on grounds of physical development can inattention to primary vital conditions be justified. The intention of physical culture is not to cultivate the organism in spite of existing defects. That would only lead to disaster, as no doubt it frequently does. The end of a scientific physical culture should be to neglect nothing that shall be of organic value. But much may be lost if the same principles of physical training are applied indiscriminately to weak and strong alike. Too exclusive attention to the importance of muscle has led many theorists to exaggerate the place of muscle in the balance of the physiological economy. If it were always borne in mind that the primary test of organisation is not muscular strength, but endurance, and steadiness of total output, muscle would fall into its proper proportion as a factor in development. For endurance is not a matter merely of muscle, neither does good muscle alone secure it. Endurance is a function of many variables—pure blood, good digestion, good circulation, good respiratory power, adequate and correct feeding, above all a good nervous system.

The intimate relation between muscle and nerve-centre, the functional correlation of every organ with every other, cannot be too thoroughly grasped if a sound theory of training is to be built up. But no teacher without a detailed knowledge of physiology and its applications in medicine can be reasonably expected to give this fact its

full importance in school training or in the physical culture possible at school. Still less shall we reasonably look for it in the ordinary drill instructor, whose ideas are usually founded on experience with the grown, not on the study of the growing. Since, therefore, the teacher and the drill instructor are the two masters of the State school child during his hours at school, it is essential either that they should be educated in medicine or that they shall have at their constant disposal the advice and assistance of medical opinion. The latter is what the Commission suggest, and this is what any proper system of medical inspection will secure.

8. *Degeneration.*

When we come to the larger question of degeneration, the case for medical inspection is as cogent as before. All that we have hitherto mentioned concerns immediately the efficiency of the school-child for his ordinary school work, and the prevention of injury from the strain placed upon him during the period of most rapid physical growth and mental acquisition. But the problem of degeneration is much vaster. Round the term "degeneration," as popularly used, cluster many fallacies, and much that passes under the name is not really the thing. In the scientific sense, degeneration presents many theoretical difficulties.

Any handbook of anthropology will show that the presence of degeneration can be settled only by an extended series of the most careful and exact measurements and observations. Consequently, if evidences of degeneration are to be built up out of the materials furnished by the children attending schools, it is essential not only that there shall be a proper system of registration on such lines as those laid down by the Anthropological Institute, but that the measurements and observations shall be under skilled supervision. It is true that the primary measurements of height and weight are easily taken, but unless they are taken by men fully informed of the purposes they subserve and convinced of the necessity for

accuracy, the possible errors may render the observations valueless. Where numbers are small, slight variations count for much. Where the numbers are larger, variations tend to neutralise one another provided the methods of observation are sound. But if a body of statistical theory is to be built up on the basis of school observations, these cannot be too carefully collected. Nor are they so likely to suffer from inaccuracy if they are entrusted to men accustomed to detailed examinations and charged with the responsibility of acting upon their knowledge. And as the primary measurements, height and weight, are simple and simply taken, the ordinary school organisations may all the more readily be expected to provide for them. The materials thus accumulated will be at the disposal of the medical inspector for the study of degeneration in a particular area or racial group, for an estimate of the nutrition of the children, for a test of growth within the period of school-life, and for a general comparison with the standards of child-life elsewhere. But these measurements and others more elaborate cannot be efficiently taken except by some one accustomed to the taking and recording of exact observations. He must be imbued with the ends that govern the nature of the measurements. If the schools are to contribute their proper share to the construction of a scientific system of physical education and to the theory of the progress or retrogression of the race, it will be necessary to place the methods of statistical observation in the hands of men skilled in the knowledge of disease conditions and in the use of quantitative methods in observation. The methods up to a point are simple, but their application is full of pitfalls. Even in a matter so apparently simple as the measurement of the breadth and length of the skull, a little variation may result in spoiling whole masses of figures. Instruments must be continually tested. Personal equations have to be watched. Similar measurements must be similarly made. The examiner must be always on the alert for errors. How difficult it is to fulfil all these conditions any one may estimate from the report

of the Anthropological Committee of the British Association, whose figures are largely quoted in the Physical Training Report.

These considerations are sufficient to show that the work of examining school children for evidence of degeneration cannot be done without skill and care, but given the care and the skill, there is little in the observations themselves to deter any school board from making progress with such work. This is a case where the medical practitioner and the layman may profitably combine their forces.

9. *General Summary.*

Education pre-supposes health. They are parts of one problem. Health is essential to education in any sense, physical or mental. And if it be the case that the conditions of health fitting a child for school life and school education cannot be ascertained without medical inspection, then medical inspection must become a part of school organisation. It is simply an additional method of securing that, as far as possible, the child shall be put into the state suitable for his training. And it is not enough to assume that his state is sound if it has not been on other grounds shown to be unsound. It is, on the contrary, necessary to assume that his state is unsound until examination for the specific purposes of school life shows it to be sound. There is no justification for chance and empirical methods here. It is the intention of the State to get the most out of its citizens, to prepare them at every hand, as far as infantile training and discipline can prepare them, for the complex strains and stresses of life. Nothing less, therefore, can be justified than the application of the most advanced knowledge to the discovery of the conditions of child-life. In practice, a great deal less than this must be accepted, but theoretically the immense importance of the issue would justify the most detailed investigation. These deductions from generally accepted propositions are justified *a posteriori* by the array of facts in the Report. The particular facts of the Edin-

burgh and Aberdeen reports would alone be sufficient to make a groundwork. But they do not stand alone. In the chapter on weight and height, we shall show that the facts ascertained in the schools of Edinburgh and Aberdeen have parallels elsewhere.

10. *Illustration from Switzerland.*

As an illustration of a fully organised system of medical inspection of schools, we may refer to the schools of Switzerland, particularly those of Zürich. In his evidence before the Royal Commission on Physical Training (Scotland), Mr. A. J. Pressland, M.A., one of the masters of the Edinburgh Academy, gave details both of the system of physical training prevailing in the Swiss schools and of the system of medical inspection. He states—" Medical examinations of children and inspection of school buildings are instituted by the Cabinet. These have been for a long time systematically carried out in Zürich town by the Central School Board. The Council of Education issues bye-laws as to buildings and inspection by the Board of Health. Permission to occupy new school-houses must be obtained from the latter. . . . The medical examination of children is prescribed on their first arrival at school. A child mentally deficient may be referred to a special class or a special institution. A child insufficiently developed may be sent to kindergarten or transferred to the list of the succeeding year.

" The authorities have power to order a re-examination of any school at any time. The examination may apply to buildings as well as to pupils. It cannot be called a general practice, as the bye-law was only passed in 1900. The Central School Board of Zürich town has instituted re-examinations, as regards sight and hearing, for a number of years. Lately it has ordered an inspection of teeth at the age of twelve. The advocates of these examinations wish to ensure proper attention to eyesight and hearing at the age of six; to eyesight at the age of twelve, when the eye begins to grow fast; to the heart at the same age for the same reason; and to the teeth at twelve, since at this age decay makes rapid progress.

"Statistics referring to these examinations will be found in the *Edinburgh Medical Journal* for July, 1902. The recent report for 1901 of the Central School Board shows that at the age of twelve each pupil has on an average 3·7 decayed teeth. To overcome the difficulty with teeth the Board advises—

"(1) The issue of a pamphlet on the care of teeth to every pupil entering the school. This pamphlet the pupil gives to his parents.

"(2) Constant reference to the necessity for care of the teeth by the teacher during class hours.

"(3) The grant of medical assistance to poor parents.

"The cost of medical examinations is estimated at 2000 francs (£80) for the town."

In the *Edinburgh Medical Journal* for July, 1902, Mr. Pressland summarises the report of the Central Education Board of Zürich town for the year 1899 to 1900. For that year the number of children under the control of the board was 22,912, approximately the same as the number in Aberdeen (25,000). The populations of the towns are practically the same—150,000.

"1. Infectious diseases comprise diphtheria, 429 (432)* cases; scarlet fever, 365 (132) cases; and smallpox, 1 (0) case. Quarantine was imposed on 877 (515) children. Measles and whooping-cough are not notifiable.

"2. Accidents at school happened in 21 (26) cases. In 11 an arm was broken, in 4 an ankle was sprained, in 2 a collar-bone was broken, and in 3 scalp wounds occurred.

"Five of the accidents happened in the gymnastic hour, 10 during intervals, 3 on the way to or from school, 1 on an excursion, 1 was due to an explosion, and 1 occurred in a *crêche*. In all cases first-aid was rendered by a competently instructed teacher, with the help of the ambulance materials which are kept at every school. No serious consequences followed in any case.

"3. Deaths occurred in 27 cases: 23 in the primary school (age 6-12), 4 in the higher grade school (age 12-15).

* Numbers in parenthesis relate to the immediately preceding year.

Tuberculosis caused 8 deaths, brain fever 5; 5 deaths were due to accident, 3 to inflammation of the lungs, 2 each to diphtheria and appendicitis, and 1 each to diabetes and heart disease.

"4. Medical examinations are made, as regards sight and hearing, in Primarklasse I., where the children are between six and seven years old, and still illiterate. In Primarklasse VI., at the age of 12-13, the sight is again tested, and the teeth inspected. *When possible, a preliminary examination is made by the teacher, who refers all doubtful cases to a duly appointed practitioner.* In any case these preparatory exercises are useful, as they accustom pupils to the situation.

"The 2625 children whose school life began in 1899 were first examined for physical and mental ailments. From this examination there appeared to be—

Mental Weakness (moderate), - -	21	cases.
,, ,, (advanced), - -	13	,,
Cretins, - - - - - -	4	,,
Psychical anomalies of other kinds,	2	,,
Imbecile, - - - - - -	2	,,
Deaf and Dumb, - - - -	1	,,
Blind, - - - - - - -	1	,,
Defective development, due to rickets and scrofula, - - -	25	,,
Defective development, due to anæmia,	3	,,
,, ,, no cause given,	30	,,
Spinal curvature, - - - -	5	,,
Lameness, - - - - - ·	2	,,
Defective speech, - - - -	10	,,
Weak health, chronic, or due to recent illness, - - - -	26	,,
	145	,, = 5·5 per cent.

"For all these children special provision was made."

The thoroughness of medical inspection thus indicated is explained by the supreme concern of Switzerland for the physical and mental efficiency of its people. Medical inspection is correlated with an extended and graduated system of physical culture. In Mr. Pressland's evidence and in the report made by Dr. Spenser and himself to the

English Education Department will be found full details of the system applied to the cultivation of child-life in Switzerland. A primary feature of the whole system is the classification of pupils according to health and physique. The facts are sufficient to show that this is essential both to education in general and to physical culture in particular. They are also sufficient to show that for the discovery of the facts medical inspection is necessary.

11. *Illustrations from Scotland.*

As a further illustration of the results of medical inspection in Scotch schools, we may refer to the Edinburgh and Aberdeen investigations. These investigations dealt with 1200 children. In Edinburgh 150 children were selected by lot from each of four schools; in Aberdeen, 100 children were selected from each of six schools. Practically, this is equivalent to a medical inspection of ten schools—four containing 150 pupils, six containing 100 pupils, each. It will be seen that in general the results correspond, so far as comparable, to those of the Zürich report.

In a recent investigation conducted by Dr. Naismith, of Ayr, and J. B. Fergusson, Esq., of Balgarth, some facts are given for children of a country school, the Alloway school. On the whole, the country children have some advantage over the average town children.

12. *Illustration from America.*

In the *Sanitarian* for June, 1903, Miss Lydia Gardiner Chace gives some facts on "What Medical Inspection means in New York Schools." She states that recently the medical inspection of schools has been improving. "Now, each physician has a certain number of schools to visit daily, when, as formerly, the children thought to need his attention are sent to him. But, besides this, he goes to each class-room once a week, paying special attention to sore throats, to contagious diseases of the eyes, and to parasitic growths of the head and skin. The result

of the inauguration of the new method was that school work in the early fall was generally upset, for it often happened in certain parts of the city that a third of the numbers of a class were sent out at one visit of the doctor." One of the most important developments of the New York system is the establishing of a nursing service for the visiting of these excluded children. "At present," writes Miss Chace, "there are sixteen nurses working in sixty-three schools in Manhattan, nine in Brooklyn, and two in the Bronx, with a supervisor, Miss Rogers, of the Nurses' Settlement." "During January the nurses cared for 13,193 cases in the schools of Manhattan, and visited 540 houses; during February 11,169 cases in the schools and visited 679 houses. In December, therefore, the Board of Health began the treatment of the trachoma (ophthalmia) cases; two wards, an operating room and a dispensary in old Gouverneur Hospital were fitted up for the purpose. The statistics for six weeks of the cases treated there show that the medical inspection of the schools is no longer a mere formality." 17,526 cases treated. The diseases on the Code for exclusion are—Diphtheria, scarlet fever, measles, chicken-pox, whooping-cough, pediculosis, trachoma (ophthalmia), acute conjunctivitis, scabies, ringworm, impetigo, tonsilitis, mumps, favus, molluscum contagiosum.

13. *Conclusion.*

Under pressure of the considerations we have sketched and the masses of evidence we have indicated, the Royal Commission on Physical Training (Scotland) recommend in the most emphatic terms that the medical inspection of schools be instituted in Scotland. With the details of their recommendation we deal later; meanwhile we consider that they have established an overwhelming case for the medical inspection of school children.

CHAPTER II.

The Form of Medical Inspection.

A. *Schedule of Royal Commission on Physical Training (Scotland).*

1. *Introductory.*

In the carrying out of a medical inspection of school children, the peculiarities of each community, of each locality, and even of each school will give rise to certain special differences of method. The predominance of certain occupations, the prevailing industries, the general resulting characters of the population are all to a certain extent reflected in the lives and habits and constitution of the school children. Accordingly, it is not possible to specify an exact form that shall fit equally well a secondary school, where the pupils are mainly of the middle classes, and an elementary school, where the pupils are mainly of the working classes. In each year of investigation, the inspection of the school may itself be looked upon as an experimental research into the social nature of the community. But in all grades of school certain broad generalities always emerge. These generalities it is possible to classify, to detail, and to use as a basis for comparative study.

2. *Royal Commission's Data.*

The investigation ordered by the Royal Commission on Physical Training (Scotland) into the health and physical condition of 1200 children had special reference to the definite problems that the Commission had set before itself, namely, the existing practice as to

physical training in schools, the dangers that such training must avoid, the actual condition of the children that are subjected to the training. From many sources the Commission had gathered facts on all these points, but criticised collections of quantities to show the condition of the Scottish schools were practically non-existent. Few concrete facts as to health, physique, and training were immediately forthcoming. The study of absences, the comparative sicknesses at different schools, and the material furnished by the sick children's hospitals and dispensaries might all have afforded some direct and indirect evidence of the prevailing health of school children. But it was naturally felt that a Commission dealing with a definite practical problem in actual administration should procure from the schools some analysed data of the conditions that would be ultimately affected by any of their recommendations. Such data to be of value for their purpose must contain something more than vague averages of health, or death-rates, or disease-rates among school children. They must exhibit a sufficient amount of individual detail to justify reasonably exact inferences regarding individual children. The work of Dr. Francis Warner, careful, comprehensive, and elaborate as it was, furnished a great mass of scientific quantities and minute observations, and of these the Commission has made full use. These quantities and observations, however, had been gathered from a standpoint not entirely the same as the standpoint of the Commission. Dr. Warner's series of researches, extending over thirty years, have always aimed at detailing all the variations from the normal that can be shown by children of school age. Among the multitudes of facts collected, many have a distinct bearing on physical growth and on intellectual progress. Many others, equally valuable from the scientific standpoint, are less valuable from the practical standpoint. And the standpoint of the Commission was nothing if not practical. They sought to ascertain by concrete analysis and observation the actual conditions of actual children living and working in the schools of Scotland.

Averages based on London children, however valuable for the purposes of comparative scientific study, left much to seek when the question of a definite code of instructions for actual schools had to be faced. The Commission, therefore, decided to initiate an investigation that should be at once representative of leading classes of school children in Scotland and a stimulus to extended application of the same principles. Many circumstances made it impossible to found such an investigation on a basis sufficiently broad to secure stable averages, the consummation of all such statistical inquiry. But the order of information sought was not confined merely to statistical averages. It was intended to bring together such facts as would make it possible to frame a concrete picture of the conditions to be dealt with. Such a picture, however, must to a certain extent rely on exact quantities; but the value of these quantities for practical purposes depends primarily on the selection of the points to be investigated, and the definitely circumscribed character of the observations.

3. *Objects of Investigation.*

With these objects, which are detailed at greater length in the Commission's Report, the Commission ordered an investigation into the physical condition of 600 children in Edinburgh School Board schools and in Aberdeen School Board schools. The original intention was to obtain data for a scientific answer to the question, what are the differences between town-bred children and country-bred children? The prevailing opinion, supported by many witnesses before the Commission, was that town-bred children tend to degenerate in physique, that the greater staying power remains with the country-bred children, and that children imported from the country into the schools of the town ultimately tend to degenerate as if they were town-bred. It is enough to say that the obvious facts of town and country life, the differences of housing, the differences of feeding, the differences of atmosphere,

the differences of social life generally, the differences of social pace, and all the derivative differences that these carry with them are sufficient not only to justify a detailed investigation, but also to ground certain general conclusions. But these conclusions, so far as Scotland is concerned, must still await their scientific verification, for it was found difficult to make such a selection of children as would eliminate fallacies from a comparison between the children of the town and the children of the country. It goes without saying that such an investigation could be of little value if limited to the individual examination of 1200 children. With the increased organisation, however, likely to be available in the near future, it is hoped that the intensive study of school children, both rural and urban, will elicit and justify conclusions of a practical educational kind. Meanwhile, as a substitute for the extended inquiry, the Commission decided to select children from two contrasted cities—Edinburgh and Aberdeen. Edinburgh, a city of some 320,000 inhabitants, partly industrial, partly residential, was likely to offer within itself contrasts of the kind desired by the Commission, and it did so. Aberdeen, a city of some 150,000 inhabitants, mainly industrial and commercial, partly residential, was also likely to offer within itself similar contrasts, and it did so. Naturally, however, the contrasts in Edinburgh were more striking than the contrasts in Aberdeen. This arose from the fact that the larger city has represented in its board schools a larger available aggregate of a poorer population, and at the same time a larger aggregate of artisans, shopkeepers, and all those that form the lower middle classes generally. In Aberdeen, on the other hand, while there is a similar available aggregate of poorer population, the board schools represent a larger proportional aggregate of the lower and upper middle classes. Further, the races that form the city of Edinburgh were likely to be rather different from the races that form the city of Aberdeen. On these, among other grounds, the examination of Aberdeen children was

likely to afford available contrasts with the children of Edinburgh. And in the result this was more or less the case. The numbers examined were too small to make even this contrast of great practical value. The differences between the two cities are in detail so great that the comparison of 600 children from one city with 600 from another might, as a matter of probability, point a contrast that does not exist between the two cities as a whole. Many factors enter into the case. Race, housing, industry, and many derivative factors must be reckoned. If it had been possible to contrast the 30,000 school board children of Edinburgh with the 25,000 school board children of Aberdeen, and to classify the results in a way to exhibit the precise differences between children of similar social grade and similar history, the contrast would be both striking and invaluable. But as the primary purpose of the Commission was, not to amass data for ultimate scientific conclusions, but to determine the next step in a practical educational question, this elaborate investigation was not instituted. Let us look in some detail at the investigation actually ordered.

4. *Nature of Examination.*

As it was impossible to make the examination comprehensive, it was decided to make it intensive. By this we mean that, instead of examining a very large number of children for a few peculiarities, the investigators were to examine a smaller number of children for a much greater number of peculiarities. If it had been decided to investigate merely the height, weight, and chest measurement, it would have been an easier matter to examine 6000 children than it actually proved to be to examine 600 when the details required were more numerous.

The following excerpts will explain more adequately the intentions of the Commission, and the grounds of their inquiry:—

V. Existing Physical Conditions.

96. Of the various factors underlying the Reference in Your

Majesty's Warrant, not the least important is an inquiry into the exact state of the children in the State-aided schools and other educational institutions of Scotland, who constitute the material to which physical training may be applied, in regard to their need of it, their fitness to benefit by it, and especially the numbers and classes amongst them who, from impaired health, or bodily or mental defects, call for exceptional precautions in its application to them. On this section of our inquiry the evidence placed before us was found to be deficient; for, though opinions were freely tendered, proved facts were few, owing to the great labour entailed and special skill called for where measurements and observations upon which statistics could be based had to be made. We therefore took steps to obtain some exact evidence in detail from examinations specially conducted, which, as will be seen lower down, has produced very valuable information.

97. The chief data which we found ready at our disposal regarding the physical condition of the inhabitants of the British Isles lay in the "Final Report of the Anthropometric Committee of the British Association of 1882-1883 (F. Galton, chairman), drawn up by C. Roberts and Sir Rawson W. Rawson," which embraces both children and adults; and the most important tables from this report have been reproduced in the appendix.

98. We were also furnished with tables regarding the measurements of girls attending the North London Collegiate School, from Mrs. Bryant, its head mistress; and regarding English and Scottish children in industrial and reformatory schools, from Mr. James G. Legge, inspector of these schools. Although fragmentary and only partially applicable to the ages chiefly dealt with in our inquiry, these data were of sufficient importance to warrant their being reproduced.

99. Of especial value was the statistical evidence, bearing specially on our inquiry, supplied by Dr. Francis Warner, the most important tables of which appear in the appendix to our report. They supply information regarding the measurements of American children of school ages, which were compiled by Dr. Bowditch, of Massachusetts, from Boston schools, and also an extensive, accurate, and valuable series of statistics concerning various matters dealing with the nutrition and the mental and physical condition of 100,000 boys and girls in English schools. They are worthy of a careful study, but it is sufficient here to say that among the most striking facts which they reveal

are that 3 per cent. of the whole were delicate or badly nourished, and 7 per cent. were mentally dull. One of Dr. Warner's tables embraces 50,000 English, Irish, and Jewish children, and shows a percentage of low nutrition varying between about four to six, and of mental dulness varying between six and fourteen, Irish children being 50 to 100 per cent. (approximately) worse than English or Jewish children, who stand nearly equal. Dr. Warner's tables further show that of 50,000 London school children, 239 were cripples, or 0·47 per cent.

100. Lieut.-Col. W. G. Don, A.M.S., supplied us with information, showing that out of about 12,000 recruits examined for the army, over 31 per cent. had to be rejected for diseases or defects, and as these figures refer to young men not very much over school age, they were considered as sufficiently germane to our inquiry to be preserved among the statistics bearing upon it.

101. We were able to obtain statistical evidence concerning the results of physical training in improving the condition of children from Mr. Thomas Chesterton and Mr. Rippon Seymour, and as it was the only evidence of this nature tendered to the Commission, their figures were considered suitable to be inserted in our records. They are valuable testimony to the benefits of physical education, as tested by the standards of height, weight, and girth.

102. But throughout all the evidence which we obtained, there was little which could be directly referred to Scotland and the children in Scottish schools. Only in one table, by Dr. Warner, were children of that nationality dealt with: 1600 Scottish were compared with over 5000 Jewish, 4000 Irish, and 38,000 English school children. These children seem, however, to have been domiciled in England, and to have been attending English schools. The table dealt with a limited section only of the physical condition of children, and we could not infer that they fairly represented the children in the schools of Scotland, with whom our inquiry was concerned.

103. It was felt that further information must be obtained, in order that a correct judgment might be formed as to the subjects in Scotland to whom physical training was to be applied, as only thus could we correctly judge of the effects it was likely to produce, of the need which exists for it, and of the precautions called for in the case of the feeble and defective. Such a step appeared also to be of importance as

likely to afford a basis for observations regarding the future well-being of Scottish children, and the results which an improved system of physical training may possibly have upon them.

104. It was obviously desirable that such information should include reliable statistics regarding both urban and rural children, if they were capable of being quickly and readily obtained. This, however, proved not to be the case. There was little difficulty with the towns, but to have collected sufficient numbers, under identical conditions, of children attending country schools, was recognised to be, for the moment at least, impracticable, and that to attempt to do so would vitiate the statistical results. It was therefore decided to select Edinburgh as one base of observation, and a town in a totally different part of Scotland as another to be compared with it, and for the latter we selected Aberdeen. It was considered that, in this manner, a fair representation of the state of matters throughout Scotland generally would be obtained, especially if the experts entrusted with the investigation were instructed to discriminate in each place between schools attended respectively by the poorest and by the better classes, and between urban and suburban schools.

105. In order to limit the time demanded for an adequate investigation, it was decided to examine, in each of these towns, 100 girls and 100 boys in each of three groups of school ages, viz., equal numbers in each year between six and nine, nine and twelve, and twelve and fifteen—which would afford ready percentages of each sex in each group, would bear prompt comparison with standard tables, and would extend over 1200 Scottish school children. This number, though not very large, would, it was expected, . . . afford data so accurate as to be unlikely to vary materially from those which a larger number would have afforded, accurate work by one or two exact observers being preferable to that of many observers over a larger field, as lessening the personal error to which observations of the nature desired are so liable. The points which we considered to be most weighty in the statistics to be collected were height, weight, nutrition, mental condition, clothing, disease, and deformity, along with such other data as could readily be gathered without unduly prolonging the task of the examiners.

107. We desire to record our indebtedness to these gentlemen for the full analytical reports which they presented to us, and our satisfaction with the care and minuteness which they

bestowed upon the examination of the children, and the various circumstances influencing their development. The co-operation that subsisted between them in carrying out our request resulted in a harmony between the schemes of observing and recording, as pursued in the two cities, which enables the one to be satisfactorily compared with the other, and renders the joint statistics of both available for our inquiries.

* * * * * *

Schools Visited.

A. *Edinburgh.*

The schools selected in Edinburgh were the following:—

(a) *South Bridge*, which lies in the east end of the city, and is attended by children from the east end, from the south, and to a less extent from the centre, the social grade being indicated by the predominance of two and three-roomed houses.

(b) *London Street*, which lies in the north of the city, and is attended by many classes of the community, including a considerable percentage of those from one and two-roomed houses, but including also a majority from the classes indicated by the three and four-roomed houses.

(c) *North Canongate*, which lies in the east end, and is attended mainly by the children of the very poor classes, as indicated by the great predominance of one and two-roomed houses.

(d) *Bruntsfield*, which lies in the west of the city, and is a higher grade school, attended by the children of those living mainly in houses of three, four, five rooms and upwards.

From a careful study of the localities, and after consultation with Miss Flora Stevenson, LL.D., chairman of the Edinburgh School Board, with Mr. Arnot, school board clerk, and with the headmasters, I concluded that these schools represent fairly the various leading classes of children attending the school board schools of Edinburgh. The results as recorded in the tables show that this conclusion is justified. No children were taken from any secondary school.

From each of these schools 150 children were taken—300 to represent the poorer and 300 to represent the better housed classes. None of the schools corresponds to the Grammar School in Aberdeen. For boys of the classes represented there, it would have been necessary to resort to the Academy, or George Watson's College, or some of the other secondary schools of Edinburgh.

In detail the percentages selected were as under:—

(a) *South Bridge.*—Daily average attendance during month of examination, 1112; number selected, 150, or 13·4 per cent.

(b) *London Street.*—Daily average attendance, 1297; number selected, 150, or 11·5 per cent.

(c) *North Canongate.*—Daily average attendance, 1303; number selected, 150, or 11·5 per cent.

(d) *Bruntsfield.*—Daily average attendance, 1628; number selected, 150, or 9·2 per cent.

The total number of children in average daily attendance at Edinburgh board schools for the period concerned was 29,425, or, approximately, 30,000.

It is convenient to remember this in estimating from the 600 examined the prevalence of any of the diseases or defects recorded; the number multiplied by 50 will give the approximate prevalence, if the same rate of incidence be assumed to prevail.

B. *Aberdeen.*

The schools were selected by a committee of the school board, after receiving an explanation of the required conditions, and consisted of four elementary and two advanced schools. The latter were included mainly to obtain the necessary number of children at the higher ages. The Middle School is in a very poor and crowded district in the centre of the city, and is attended mainly by the children of the poorer of the working classes. Skene Square School is situated on the margin of a somewhat similar, but less crowded, district, from which its pupils are largely drawn. King Street School is also in a part of the city chiefly occupied by the working classes, but of the average type, and largely artisan. The immediately surrounding district is not overcrowded or slummy. Ashley Road School is in the west end of the city, and is attended almost wholly by children of the well-to-do classes. These were the four

elementary schools visited, from which all the younger children were taken. Of the two advanced schools visited—the Grammar and the Central—the former is the chief secondary school for boys under the school board, and is attended chiefly by boys of the better classes, including some boys from the country, while the latter is a higher grade school in the centre of the city for both boys and girls, but mainly girls, who are drawn principally from the middle classes and better-off working classes in the city.

Table I. also gives the size in rooms of the houses from which the examined children came, and shows that the children are divisible into three nearly equal groups, according to the size of house, viz., one group from one and two-roomed houses, a second from three-roomed houses, and the third from houses of four or more rooms. In Aberdeen, according to the last census, the proportion of the population occupying one and two-roomed houses was 39 per cent.; three-roomed houses, 30 per cent.; and houses of four or more rooms, 31 per cent. Accordingly, the housing of the children examined corresponded approximately in character with the housing of the population generally.

Selection of Children.

A. *Edinburgh.*

(a) *South Bridge.*—The names of all the children at each age from six to fourteen were brought together, numbers corresponding to these were placed in a hat, and out of this, 150 were taken blindly, equal numbers of male and female being taken at each age.

Of those selected, one or two were absent on the day appointed, and one objected to the examination, but these contingencies had been provided for by a ballot selection of some reserves.

(b) *London Street.*—Here the odd numbers of the various registers were taken to the extent required. This is a usual method in the inspection of schools. The names on the registers are not in any specific order, the order being determined by the series of chances that bring the child to school on a particular day.

In *North Canongate* and *Bruntsfield* the same method was followed as at London Street.

From a careful scrutiny of all the children in the various schools at various times of the day, I am entirely satisfied that the selection was representative. In one or two instances, regret was expressed by the teachers that their best children had not been taken, but every one realised that the value of the observations depended largely on the pure chance nature of the selection, and there was no attempt to evade the methods indicated. In one or two instances, parents objected; but the places of their children were at once taken by the reserves. In several instances, special requests were sent by parents to have their children examined, particularly for ear defects. This was done, and advice given.

The examination aroused the keenest interest in the children themselves.

In two cases of a peculiarly pathetic nature, I informed the headmaster that the children were suffering from acute phthisis. He, in turn, informed the parents. I learned afterwards that the latter were profoundly grateful for the information conveyed, and at once took steps to place their children under medical treatment. In at least one other case of phthisis the parents were aware of the fact that the child was affected.

From some of the schools it would have been possible to select a much superior set of children and a much worse set.

The only point in the selection that might possibly give rise to wrong inferences was the impossibility of obtaining the full number of children of ages fourteen to fifteen. Only in one school were there sufficient children to make a ballot possible for the full number. Consequently, I had to make up the group of twelve to fifteen from a larger number of those at the lower of the three years of age. The only figures that can be seriously affected by this difference are the average weights, heights, and chest measurements at those ages. To eliminate this source of error I have had the comparison between the schools made, first, with the fourteen to fifteen average included, and then with this average left out. The results are shown in the appropriate table. The difference is not great.

B. *Aberdeen.*

I regret that the school board considered it necessary for me to obtain the consent of the parents of each child before examination, as it interfered to some extent with the purely random choice of the children which had been intended. The

procedure, as approved by the board, was, in the first place, to make a chance selection of the required number of children at the desired ages, either by ballot or by taking, say, every fourth or fifth child on the class register. An addition of 15 to 20 per cent. was made to the number to cover possible refusals. A circular, approved by the board, was then addressed to the parents of each selected child, asking them to inform the headmaster if they objected to the proposed examination. The proportion of refusals averaged not less than 15 to 20 per cent. over all the schools visited. The reasons for refusal were not usually stated. In one or two schools an impression had got abroad that the examination would involve considerable undressing, and this was objected to, especially by the parents of the older girls. It is not, however, believed that these refusals have seriously interfered with the fairness of the sampling. The fact of previous consent being required has diminished somewhat the proportion of children who were irregular in attendance, as these were most likely to be absent in largest proportion on the day of examination.

5. *General Description of Schedule.*

The schedule devised by the investigators—and it is proper to say that the design and elaboration of it were principally the work of Professor Matthew Hay—contained more items than the Commission had at first contemplated. But both investigators felt that, although the labour of observation would be increased, the opportunity for obtaining some purely anthropometrical facts was exceptional, and ought to be used. Accordingly, some items of the schedule have no direct bearing on the question of physical training or of health; but these items are very few. Even the measurements, numerous as they are, have each of them some definite relevance to training and physique. Of the colour of hair and eyes this cannot be said; but it is true of every other item in the schedule. It may here be stated that by much the most laborious part of the investigation was the measurements other than the measurements of height and weight. These last are easily and rapidly taken.

6. *Fundamental Principle.*

The schedule was constructed on definite principles after a full discussion, as it were, on the "second reading." The primary object was not to make an exhaustive physiological study of the school child, but to gather in a single document every important fact bearing on the child's efficiency for school work in the actual conditions of school life as it is to be found in the school board schools of Edinburgh and Aberdeen.

From this general statement some deductions are immediately obvious:—The schedule had to contain a heading to indicate its authorisation, namely, the Royal Commission on Physical Training (Scotland). It had to contain the name of the particular city and the name of the school; both being essential for the contrasts afterwards to be constructed. As the Commission's Order covered only children of age from six to fifteen years—a definite number to be taken from three groups within those years—an age-group heading was essential. The conditions of school life may affect differently the different sexes, and the Commission required information accordingly. The schedules were, therefore, primarily classified into schedules for males and females—the "males" being printed on white paper, "females" on blue. This was for convenience of classification. The items in both schedules are precisely the same. Since there is a recognised difference between the physical state of children at the beginning of the school session and at the end, the date of the session's beginning was recorded. The date of the medical examination was correlative to this, and was also recorded.

7. *Identification and Social Grade.*

That the child might be identified and made a definite quantity it was necessary to record the name, the date of birth, the age in years and months, the residence, the number of rooms, and the father's or mother's occupation. These items scarcely need justification. In all schools the date of birth is essential to registration, and it was

easily obtained. It is a very necessary check on the statement of age. In the passage from the infant school to the higher standards, age is an essential element. Consequently, there was no difficulty in obtaining both these items from the teachers. The residence, too, is important, because it is a general index of the locality. The number of rooms is important, because, as the results show in a very striking way, the populations frequenting one-roomed houses are, in many respects, different from those living in houses of more than one room. The house, in fact, is the best index of the child's place in the social scale, and, therefore, of its ordinary environment. The occupation of the father or mother supplements the information otherwise ascertained. In some cases the previous death of the father or the mother had its very definite results represented in the nutrition and general condition of the child. Unquestionably, the parent's occupation and the habitual dwelling are among the most important factors of the child's development.

8. *Mental Grade.*

(a) *School Standard.*—The efficiency of the child for its work is relative to the grade of work required of it. Fortunately, in the State schools the division into standards is carried out so definitely that the grade of work is always approximately ascertainable. It may be that a classifying of capacity by standards is only a rough approximation, but it is almost as definite as the classification in non-State schools, where capacity is, or ought to be, the sole determining factor. Against the classification by standards much may be said; it was obviously a device of a bureaucratic department to facilitate the work of organisation and inspection, and, from that standpoint, it has many virtues and some defects. But, primarily devised for the purpose of management, it has, on the whole, lent itself to the purposes of classification by capacity. The faculties of children do not advance in straight lines, nor by definite stages, nor yet in definite sequence or simultaneity. But on the larger average,

age roughly indicates the advance of mental growth; the teacher is left with much discretion in placing children backward or forward, and now that the system of payment by general results, not by individual examination, is established, a standard of study becomes a somewhat more accurate index of the mental grade. Accordingly, the capacity of the child is defined in the schedule by the standard of study. The "position in class during last term" was added; but, as simultaneous training of children has increased, the placing of individual children in definite class-positions according to a single subject has tended to cease. In the Aberdeen schools, the placing in definite positions appears still to be maintained; in none of the Edinburgh schools examined was it possible to get definite data. The system has been dropped. As a supplement to the position in class, "the number of pupils in class" was added. This item, although primarily related to the position as high or low, is of independent value. In the larger schools it is the custom to select specially backward children for independent training in small classes. Consequently, the number of a class is a rough index of intellectual capacity and of the ground that the teacher's estimate of such capacity is based upon. All such estimates are roughly relative; it is obvious, to take an extreme instance, that the best of a class of three would not ordinarily have the same value as the best of a class of one hundred.

As bearing on class-position, the question was put—"Has position been improving?" This is capable of a general answer without definite class places. The teacher's general impression is of value, because it is formed usually from several months of observation. When the answer to this question was negative it was practically always found that the other items of the schedule gave definite information to account for the want of progress.

(b) *Teacher's Opinion.*—Next, the schedule required "Teacher's opinion of mental capacity." Here there was naturally great variation. The children were chosen from

different classes; each class was under a different teacher; each teacher differed in experience and judgment. Further, children were taken from several different schools; the standards of one school differ from the standards of another; the methods of estimating capacity are also tinged by the character of the particular school as a whole. At the same time, it is to be remembered that part of the teacher's daily business is to estimate mental capacity and to adapt his teaching to it. From period to period of each year he has to gauge the progress of the child. From year to year he has to prepare the child for transference to the next school stage. He becomes, therefore, a trained judge of mental capacity and progress within the limits of his teaching. Accordingly, in spite of the personal equations necessarily emerging, the judgment of mental capacity presented a very striking uniformity. In very few cases was it found that a child judged excellent by the teacher could be declared less than excellent by the medical examiner. Obversely, those judged by the teacher to be defective were found to be so in many physical particulars. The three middle grades of good, bad, and dull afforded ample margin for variation, and, on the whole, the opinion of the teachers was an important guide to the formation of an opinion by the medical examiner. Further, as the examiner passed in review every child of the 600, he was able approximately to standardise the differences in the judgments of the teachers. In this way, therefore, the classification by the teacher's opinion on mental capacity into excellent, good, medium, dull, defective, became a most important item in the schedule. It afforded the basis for new correlations of the several facts. For example, it made possible an estimate of the part that any physical defect plays in obstructing the progress of the child. It afforded suggestions to check the value of good or bad physique as a condition of mental culture. It made it possible to say that good physique was not uniformly correlated with good mental capacity, and that good mental capacity

was not always correlated with good physique. The instances were not infrequent where feeble mental capacity was associated with excellent physique, and where feeble physical capacity was associated with high intelligence. This is easily understood. All the systems do not develop simultaneously; the nervous system may predominate at one stage, the muscular system at another; the intellectual functions of the brain in one child, the volitional functions in another.

(c) *School Attendance.*—Compulsory attendance at school is, as we have shown, an essential part of the Scottish school board system. Absence from school has, therefore, ceased to depend either on the whim of the child or on the immediate necessities of the parent. Consequently, "regularity or irregularity in attendance" has grown into a test of the child's physical ability. Reasons for irregularity are registered; they were obtained from the teacher, and in many cases threw an important light on other features of the schedule. Regularity of attendances where attendance is compulsory, as in Scotland, does not have the same significance as it would have where attendance is voluntary. It does not of itself arise out of good and constant character either of the child or of the parent—at least not directly. Nevertheless, it is an important index of social education. The school board officers are perpetually active in keeping the parents up to the mark, in urging them to send their children to school, in organising prosecutions when they do not, and generally in resisting the influences that make for bad attendance and bad education. And once the habit of attendance is established the school board officers find that their work is mainly among those whose circumstances naturally tend to distract them from the care of their children. The majority of all classes are fully awake to the importance of regular attendance; the children themselves gravitate to school, and thus regularity in attendance, in spite of the compulsion in the background, affords some evidence of constancy in character.

The basis for estimating such regularity as would have a bearing on the physical condition of the children was formed after a careful study of the average attendances in the Aberdeen and Edinburgh schools. According to the Scotch Education Code, a certain minimum of attendances in each year is essential for the earning of the education grant. Accordingly, exact records of attendances, and, therefore, absences, must be kept. When averages over many years are taken it is found that, on account of one disability or another, accident, or migration, or climatic variations, or epidemic disease, or general ailments, or social or domestic circumstances, the absences over any one year remained a fairly constant quantity. It is possible to classify attendance as good, medium, and bad, and to give to these terms an exact quantitative meaning. Different towns vary considerably in their minimum records of absences. It was found that Aberdeen and Edinburgh did not differ so greatly that the adoption of a single standard would do any injustice to either city. The greater percentage of absences was, as a rule, found in Edinburgh; but the differences were not great. Accordingly, it was decided that where a child's absences during the last or the current term were under eight per cent. of the total attendances, his attendance should be counted good; where the absences were over eight per cent. but under sixteen per cent., the attendance should be counted medium; where the absences were over sixteen per cent. the attendance should be counted bad. The resulting quantities, as shown in the tables, were, on the whole, consistent with the other features of the schedule. Bad attendance, dulness, and defects in organs or health were not infrequently found in association.

The precise significance of school attendance is best grasped from a study of what it involves at school. A child that, during nine years of rapid growth, is able day after day, week after week, month after month, and year after year, to maintain attendance for the full day at school must have good parents or guardians; he must

have good physique; he must have good will power, good intelligence, good capacity for education. The enormously complex system of school life becomes to him an organising ideal. He begins by being taken to school; he ends by going of his own wish.

As a supplement to "the regularity of school attendance" it was important to ascertain "the cause of irregularity." This also was frequently a good index both of the child's capacity, physical and mental, and of the home conditions. The supplementary question, "Has attendance been improving?" was also asked. The information on this point was frequently somewhat vague; but on the whole it was the case that the bad attenders remained bad attenders throughout the whole school course.

How important the question of attendance really is may be further shown by a study of the elaborate conditions prescribed by the Education Code, which is adapted to the necessities of many varieties of pupil. The question of occupation as affecting attendance and school efficiency generally will be dealt with in Part II.

Scotch Education Code, 1903.

According to the Code, *Article* 19 (B), 1.—"The following grants may be made, (*a*) on the average number in attendance throughout the year of children under seven years of age, a normal grant of 18s.; (*b*) on the average attendance of children between seven and ten, a normal grant of 20s.; (*c*) on the average attendance of children over ten years of age for whom grant is not claimed under the provisions of Article 21, or Chapter IX., a normal grant of 22s."

From this article it is clear that the average attendance is the fundamental fact in determining the financial position of the school. The other sections quoted below will show that it is also the fundamental fact in determining the mental and physical load placed upon the child. Being thus in all respects fundamental, attendance becomes the primary problem for the school managers.

The greater the average attendance the greater the earning power of the school. The motive to enforce attendance is, so far as the school managers are concerned, a directly economic motive. Incidentally, it secures the education of the child.

Article 19 (F).—"Where the Department are satisfied that, by reason of a notice of the sanitary authority under Article 30, or any provision of an Act of Parliament, requiring the exclusion of certain children, the average attendance has been seriously diminished, and that consequently a loss of annual grant would, but for this article, be incurred, the Department have power to make a special grant not exceeding the amount of such loss in addition to the ordinary grant."

By Article 19 grants are made "to the managers of a school which has met not less than four hundred times in the morning and afternoon in the course of a year, as determined by Article 11.

"If a school has been closed during the year under medical authority as necessary to prevent the spread of epidemic disease, or for any unavoidable cause, intimation having been duly given to the Department at the time, a proportionate reduction is made from the number of meetings (four hundred). If the school is closed on account of epidemic or other unavoidable cause for X weeks, the number of meetings will be $\frac{46-x}{46} \times 400$."

Article 23—"*Calculation of Attendance.*—Attendance at a morning or afternoon meeting may not be reckoned for any scholar who has been under instruction in secular subjects less than two hours (this may include an interval of fifteen minutes for recreation during a meeting of three hours, or five to ten minutes in a shorter meeting), or in an infant school, or infant division, or class for defective children, one hour and a half (not including any time allowed for recreation);

(*a*) Between the first of November and first of April two attendances may be registered for any scholar who has been under secular instruction

for four hours, in the morning and afternoon taken together.

(*b*) Two consecutive hours are reckoned as an attendance and a half in the case of

(1) Scholars who are liable under any half-time Act.

(2) Scholars residing two miles or upwards from a suitable State-aided school.

(*c*) No additional attendances shall be reckoned under sub-section (*b*) of this article for any scholar who has not attended at least 200 times in the course of the school year; and the additional attendances shall be limited to such a number as, when added to the number of actual attendances, will give a total equal to three-fourths of the number of attendances which each scholar could have made during the year."

Article 24.—"The attendance of scholars at military drill, or swimming lessons, under a competent instructor, or at any other form of instruction provided for in the time-table and approved by the inspector as being of the nature of, or contributing to the efficiency of, the instruction under Article 19 (*a*), 4, 5, 6, and 7, may be counted as school attendance for such number of hours as is shown in the time-table approved by the inspector.

"Should it be desired to count as school attendance attendance at special lessons occurring irregularly, and not provided for in the time-table, due notice of the time and place of such lessons shall be given to the inspector, and his approval obtained. Sanction under this article for visits to museums, or for any form of outdoor lessons, will not, as a rule, be given, except in the case of military drill, for more than eighteen scholars at a time, under the charge of one teacher."

Article 25.—"Attendances may not be reckoned for any scholar in a day school under three or above eighteen years of age."

Article 26.—"The average number in attendance for any period is found by adding together the attendances

of all the scholars for that same period, and dividing the sum by the number of times the school has met within the same period; the quotient is the average number in attendance."

Article 30.—"Where the managers have complied with any notice of the sanitary authority of the district in which the school is situated, or any two members thereof acting on the advice of the medical officer of health, requiring them for a specified time, with a view to preventing the spread of disease, or any danger to health likely to arise from the condition of the school, either to close the school or to exclude any scholars from attendance, they may appeal to the Department if they consider the notice to be unreasonable."

This is a most important article. It provides for the direct interference of the sanitary authority (the local authority for public health) with the health conditions of the children. The extensive powers of the local authority in this regard will be fully discussed at a later stage.

When the regulations of the Code are thus studied in detail they will be found to present in themselves small reason for fearing that the children working under them should suffer from over-work or exhaustion. If the conditions were uniformly healthy, and if the strict letter of the Code were always adhered to, this inference would be safe. But as the facts gathered in the Edinburgh and Aberdeen investigations effectually show, the conditions of the school do not embrace the whole environment of the child; the work of the school may include mental and physical activities unsuited to particular children; the persistent necessities of the school may press wrongly on defective organs. It follows that the ideal of the Code cannot be achieved in all cases as if all the individuals were perfectly healthy and normal. For healthy and normal children the Code does not seem strikingly inconsistent with the physiology of the growing, provided always the hygienic conditions of the school are strictly maintained. The alternation of

task-time and play-time is physiologically sound. A doubt arises when the school hours of the older children are examined in detail. The modern tendency among secondary schools is to secure that all the strictly acquisitive work is ended with the fresh morning hours, and that the afternoon is left chiefly for recreation.

9. *Physical Exercises.*

One of the main objects of the investigation was to ascertain the existing exercises prevailing in the schools. Already, and for the last ten years, the school boards have been required by the Scotch Education Code to give facilities for physical culture. "This scheme of work shall, in all cases and for all divisions, make provision for (*a*) adequate physical exercise according to an approved system. In the senior division this exercise may take the form of military drill." (Code of Regulations for Day Schools, 1903, Article 19 (A), 4.) In the majority of schools, at least in the large towns, such facilities have been abundantly given. In many cases commodious gymnasia have been provided, drill instructors are in daily attendance, teachers have been specially trained in the drill necessary for free and other gymnastics, and, generally, the most popular and best-known principles of physical training have been in one degree or another systematically applied. For the full extent of these exercises in the schools of Scotland, the Commission's Report and the evidence that forms its groundwork must be consulted.

(a) *Systematic.*—In view of these facts, the investigators decided to record "the forms of systematised exercises, if any; their daily duration; the years they have been practised." The information elicited on these points was not such as could be classified in detailed correlation with the health of individual children, the facts being somewhat too various and too few to make sound inferences possible. But sufficient information was obtained to make possible an approximate comparison between the amount of exercise practised at

different schools. If it were found that in two schools differing materially in the physique of the children the amount of physical exercise was approximately the same, it would follow that the differences in physique were due to other causes than physical training. As will be shown in detail later, something approaching this was exhibited in the comparison between the two extreme schools examined in Edinburgh—North Canongate and Bruntsfield. In another of the four schools, where physical training predominated, there were certain indications of excessive strain. These general statements are made here merely to indicate that, in gathering information on systematised exercises, the investigators had in view concrete conditions that were certain to yield some definite information.

(b) *Games.*—As a supplement to systematised exercises, "outdoor games, their kind and amount," were also recorded. In all schools examined, outdoor games were found to be a very prominent part of the exercise. In no case could it be legitimately said that they were in any degree displaced by any of the forms of systematic exercise required by the schools. The school-time available for outdoor games may be inferred from Article 23 of the Code:—"Fifteen minutes for recreation during a meeting of three hours, or five to ten minutes in a shorter meeting." No school-meeting need last more than three hours. Between the morning and the afternoon meetings, there is usually an interval of an hour to an hour and a half. The interval varies in different schools and for different classes. The custom in rural schools differs from the custom in town schools. Approximately, in all the schools five nominal working hours (including the time given to religious instruction) are aimed at. From this may be deducted, for permitted recreation, twenty-five minutes (fifteen minutes forenoon, ten minutes afternoon), and an average of five minutes per hour (twenty-five minutes in all) as "leakage." The five hours of attendance thus become four hours and ten minutes of actual work. Before and after school

hours the child is, or ought to be, free, except for the time given to "home lessons." In the lower and middle school classes, such lessons occupy a small part of the non-school time. But it would be important, on occasion, to ascertain what amount of non-school time continues to be filled with work, and what amount is given to relaxation. The time available for outdoor games consists of the school-time of twenty-five minutes, *plus* part, on the average one-third, of the mid-day hour; of the non-school time, the period from 3.30 or 4 p.m. to the child's bedtime, *minus* the amount given to home lessons (say, one hour on an average for the middle-school classes; two hours for the upper-school; varying amounts for higher classes), or to regular labour. In the country the walk to and from school must be regarded as recreation.

A heading for "other forms of exercise" was added to provide for such possibilities as swimming, or any particular drill or brigade work carried on outside school hours. Swimming, however, may be included within school time.

The information on practically all the scheduled details up to this point was obtained without difficulty from the teachers of the various schools. Most of the items were taken direct from the ordinary registers; others were ascertained from the children themselves. It is probable that some of the items obtained from the latter source are of doubtful accuracy; but, in the great majority of cases, they may be taken as reliable, for they conform generally to the information otherwise obtained.

In a separate chapter, it is shown in detail how much of a medical inspection schedule the teacher may properly undertake. To judge by the large amount of exact information obtained in this investigation without serious interruption of school work, we have no hesitation in saying that, with the cordial assistance of the teacher, medical inspection will become easier and of incalculably greater value.

10. *Personal Appearance.*

The remaining items of the schedule follow in an order convenient for recording. Each item, with the exception of the anthropometrical items already referred to, were chosen strictly from the standpoint of school efficiency.

Under "Personal Appearance" come complexion—pale, medium, ruddy; health appearance—good, medium, bad; state of nutrition—stout, medium, thin; brightness and alertness—good, medium, bad; carriage and general balance—good, medium, bad. It will be obvious that these items have a direct reference to the superficial aspects of health. The relation between complexion and health appearance is important—the one observation acting as a check on the other. The state of nutrition may be ascertained first by simple inspection, and subsequently by weighing. It is important that both the inspection and the weighing should be recorded, since the first is a cue to the second. It was proper to record brightness and alertness, because these qualities vary according to discipline, and in the evidence taken by the Commission it is frequently maintained that school discipline, and, in particular, physical drill, are important factors in increasing the brightness and alertness of children. As a general truth, this may be accepted; it is certainly true of the adult soldier, who from a clumsy recruit rapidly passes by drill and discipline into an alert and springy "regular." In the earlier stages of school life, however, these results are less obvious; but it might reasonably be expected that the tone of a school and the quality of the discipline would be in some measure reflected by the alertness of the children. Doubtless, brightness and alertness are primarily a function of mental capacity; but it is well known that mental capacity and alertness do not always manifest themselves in the same way. Frequently, children of good mental capacity come of clumsy and badly-developed stock; their nutrition may be different from children of less brain; in the early stages they may be dull; in the end, their staying power may enable them to triumph over all com-

petitors. But on the whole it may be accepted that mental capacity in some form or another, and alertness, which has reference rather to the ordinary routine of the day, will roughly correspond. To provide for the mere muscular expression of alertness, it was decided to include "carriage and general balance." In the scrutiny of these, it would naturally be unfair to apply the exacting standards of high military drill or of first-class gymnastic form. It was felt that the observation might be of value in two respects, first, as showing the congenital defects of the child; and, second, as indicating what defects physical training might be expected to improve. How far these anticipations regarding personal appearance were realised, subsequent details will show.

11. *Cleanliness.*

Although not directly relevant to physical training, cleanliness of clothing and body is undoubtedly relevant to school efficiency; for it is an index at once of the spontaneous taste of the child and of the character of the parent. A dirty young child means a dirty mother. A dirty older child means a bad history and a bad environment. Dirty clothing means neglect at home. A dirty body means parental incapacity and ignorance. Cleanliness, therefore, may be taken as the surest index of habit and character both of parent and of child. It can scarcely happen that a very dirty child comes from a clean house, nor is a clean child likely to come from a dirty house. One of the chief effects of school life is to raise the standard of cleanliness. Every school is, or ought to be, provided with full appliances for washing. Recently, the Education Department has drawn the attention of school boards to the primary importance of this question. The Local Government Board has supplemented the Education Department's circular by a circular of its own:—

Scotch Education Department,
London, 10th October, 1901.

Sir,—My Lords have had under special consideration the

difficulties presented to school boards in enforcing the attendance at school of neglected children. The more ordinary aspects of this question need not be referred to, where the question is simply one of truancy, due to absence of home control, vagrancy, and general wildness. It is sufficient here to suggest that, in dealing with these cases, school boards should avail themselves, more freely than is usually the case, of the assistance that may be obtained by co-operation with the police authorities, which will be specially useful to them in obtaining knowledge of and securing the attendance at school of children belonging to the migratory classes, who may otherwise escape the usual school board census.

But it is to a special class of children that my Lords wish now to direct attention, viz., of those who, either by disease, uncleanness, want of clothing, or other results of neglect and unwholesome conditions, are rendered unfit to sit in school with other scholars. Such children, it is to be feared, are too often allowed to remain away from school for long periods, and even to grow up without the benefit of any education at all, with consequences not only harmful to the children themselves, but dangerous to society.

While recognising that the physical condition of such children, and the dangers to other children arising therefrom, may be "reasonable ground" for refusing admission to them in terms of Article 17 (a) of the Code, my Lords must hold that school boards are none the less responsible for their obtaining education; and that it is, therefore, the board's duty to use every means in their power whereby their condition may be sufficiently improved for them to attend school. In this they feel sure that they will have the full agreement of school boards. Some doubt may, however, be felt as to a board's power to cope with this difficulty, and it is their Lordships' present object to point out some of the resources available for the purpose.

The most important of these is, doubtless, the individual effort of school managers themselves, who by personal influence can effect much that lies beyond the reach of a corporate body. On the other hand, in order to be really effective, such effort should be employed, not in a desultory manner, but as a supplement to a systematic plan of action on the part of the school board, acting both by themselves and in co-operation with other bodies. It is to the importance of such co-operation that my Lords desire to call special attention.

Mention has been made of the assistance that may be and, in certain cases, has been obtained by school boards from the police authorities in dealing with cases of truancy. Similarly, in dealing with the class of children who are rendered unfit to attend school by conditions due to filthy and insanitary homes, it is of immense importance that the school board should act in concert with the local sanitary authority. I am to refer the board to the Public Health (Scotland) Act, 1897, generally, and especially to section 40 of that Act. It is evident that much might be done by systematically reporting to the local authority cases to be dealt with by them under this Act. In burghs a similar use may be made of the Burgh Police (Scotland) Act, 1892, sections 118 and 119. Attention is also called to the Cleansing of Persons Act, 1897. Instances already exist proving the extent to which officers of the school board and of the local authority can render each other mutual assistance, and my Lords have little doubt that any school board will obtain from the local authority all the aid which they ask for, if they bring themselves or their attendance committee into systematic relations with them.

By acting on these lines school boards may be able largely to reduce the number of children of the class now under consideration. But there will remain cases which are beyond the scope of such action, especially those of confirmed disease. Many of such diseases are of a more or less infectious nature and, in any case, they are most repugnant to other children. The risk of infection, however, is almost entirely removed and the repugnance is mitigated, if the sores or affected parts are properly dressed. My Lords are advised that it is beyond the power of the board to provide medical treatment out of the school fund; but a substitute for paid service may, perhaps, be found in philanthropic agencies having medical aid within their scope, and it has been suggested that every school in which such cases occur with any frequency might be associated with some society of this kind. Either in this way, or by other means which may suggest themselves, the board should endeavour to secure that every such case is either properly attended to by the parents themselves or that, where the parents or guardians are from whatever cause incapable of giving proper attention, they should be put in the way of obtaining the necessary assistance.

The form in which the question under consideration occurs

will naturally differ widely according to the character of the school district, as will also the means at hand for dealing with it. But in all cases it is hoped that the school board will recognise the duty to deal with it which is implied in their duties under the compulsory clauses of the Education Acts, and will seriously consider in what direction their present practice in the matter may be extended.

It has been thought expedient to enclose, for the information of your board, a copy of a circular, relating mainly to the same subject, which is being issued by the Local Government Board to local sanitary authorities.

H. CRAIK.

CO-OPERATION OF LOCAL AUTHORITIES AND SCHOOL BOARDS.

Local Government Board,
Edinburgh, 10th October, 1901.

SIR,—The Local Government Board desire to direct the attention of local authorities to the mutual advantages of co-operation with the school boards in their districts in the discharge of their respective duties.

It is unnecessary to dwell on the national importance of the health of children, on the influence thereon of the physical conditions existing at home and at school, on the relations of both to education, and the consequent practical utility of sympathy and active friendliness between local authorities and school boards. It need scarcely be added that approaches by either body to the other regarding these subjects of common interest ought to be made without censoriousness and received in a friendly spirit.

Through section 57 of the Public Health (Scotland) Act, 1897, relative to infectious diseases and school attendance, and Article 30 of the Education Code regarding closure of schools or exclusion of scholars on the notice of the local authority, a certain amount of administrative co-operation is required and recognised. The Board are aware that between many local authorities and school boards and their respective officials there already exists a carefully organised system of co-operation for the prevention of the spread of infectious diseases through the agency of schools, which experience has shown to have great utility both in the control of epidemics and the promotion of

education. The Board are satisfied that without such co-operation it is impossible to deal effectively with the infectious diseases of children.

By the definition of "house" in the Act, all the statutory obligations of the owners of dwelling-houses are laid upon school boards as regards school premises. There are also provisions specifically applicable to "schoolhouses" in sections 16 (8) and 29. In the great majority of cases the primary structure of such premises is unexceptionable, and calls for no interference on the part of the local authority, but in maintaining the structure, especially in the prompt detection of defects in drains and plumber work, disrepair or irregularity in the cleansing of conveniences, &c., school boards require the assistance of local authorities. This ought to be freely rendered by the exercise of regular supervision over schools.

These points of administrative contact between local authorities and school boards are plainly indicated by statute. Other opportunities of co-operation ought to be sought in pursuance of a settled policy of helpfulness.

The Board are informed that school boards sometimes have difficulty in dealing with children who present themselves at school in a state of uncleanness so gross that they cannot be allowed to mingle with other children. In cases where this is associated with a "filthy or unwholesome condition" of the home and its contents, the local authority should, on receiving information to that effect, consider as to the exercise of their powers under section 40 of the Public Health Act, 1897. In burghs the provisions of sections 118 and 119 of the Burgh Police Act will also be available. It ought to be remembered that such conditions as defective water supply, darkness and want of ventilation, disrepair of floors, walls, &c., want of proper w.c. accommodation, encourage personal and domestic uncleanliness.

In this connection the Board direct attention also to the Cleansing of Persons Act, 1897. That Act provides—

> "1. On and after the passing of this Act any local authority shall have the power, when in their discretion they shall see fit, to permit any person who shall apply to the said authority, on the ground that he is infested with vermin, to have the use, free of charge, of the apparatus (if any) which the authority possess for cleansing the person and his clothing from vermin.

The use of such apparatus shall not be considered to be parochial relief or charitable allowance to the person using the same, or to the parent of such person, and no such person or parent shall by reason thereof, be deprived of any right or privilege or be subject to any disqualification or disability.

"Local authorities may expend any reasonable sum on buildings, appliances, and attendants that may be required for the carrying out of this Act, and any expenses for these purposes may be defrayed out of any rate or fund applicable by the authority for general sanitary purposes or for the relief of the poor."

"3. In the application of this Act to Scotland, 'Local Authority' means and includes any local authority under the Public Health (Scotland) Act, 1867, and any Acts amending that Act; but the local authority shall not erect buildings for the purposes of section 1 hereof, except with the sanction of the Local Government Board for Scotland."

Local authorities should, on the application of any school board, be prepared to consider how far they can exercise their powers under this Act and afford facilities for cleansing the persons and clothing of children. If any local authority should resolve to erect buildings for the purpose, the Board will be ready to give the sanction required by section 3, unless strong reasons exist for refusing.

I am further to remind local authorities that, in the execution of their duties under the Education Act, the officers of school boards are frequently led into houses and localities which stand in need of sanitary supervision. In the course of their domiciliary visits they cannot fail to observe various "nuisances" and insanitary conditions.

The Board are aware that in certain of the large burghs the systematic communication to the local authority by the school board of the observations thus made by their officers has been encouraged and has proved of signal service to the local authority in the execution of their duties. The Board highly approve of all such understandings and recommend them for the adoption of local authorities generally.

I am to express the confident anticipation of the Board that medical officers of health and sanitary inspectors will cordially welcome the assistance which the officials of school boards may

in this way render, and will generally aid their local authority in acting upon the lines of this circular.

Three copies of this circular are sent, together with three copies of a circular addressed by the Scotch Education Department to school boards, and I am to request you to submit these circulars to an early meeting of the local authority and to hand copies to the medical officer of health and sanitary inspector for their information.

G. Falconar-Stewart, *Secretary.*

From the foregoing circulars it is obvious that, in giving to cleanliness a primary place, the investigators were following out the wishes both of the Commission and of the Department.

12. *Measurements.*

Measurements of some sort were an obvious necessity, since they alone could give definiteness to simple inspections. The problem was how many measurements it was justifiable or necessary to record for each child. Such measurements may be taken from at least three standpoints:—First, they may be taken in order to build up a body of statistical material for the study of racial peculiarities. This is the anthropological standpoint. Second, they may be taken for the purpose of estimating the effect of physical training. This is the developmental standpoint. It was from this standpoint that Maclaren made his elaborate observations from month to month and year to year on the growth of boys subjected to continuous physical training. Third, they may be taken for the purpose of studying defects or abnormalities in general. It is mainly from this point of view that Dr. Francis Warner's measurements have been made. The standpoint of the investigators was, however, none of these three, yet the outlook from it had to include elements from anthropology, from development under training, and from the study of diseases or abnormalities. Primarily, the measurements were intended to have relation strictly to school efficiency;

incidentally, they furnish some material for anthropological and developmental study.

The primary measurements necessary for all purposes were weight and height standing. The paramount importance of these and their relation to nutrition will be set forth in a special chapter. The height sitting was also taken; but any inferences from it are rather anthropological than educational.

The head measurements could not be regarded as having any direct bearing on physical or mental development or efficiency; but, as pointed out in the Commission's Report (p. 24), they afford some data for determining the purity or mixture of races. The question of race, though not directly affecting the question of school efficiency, must be excluded or allowed for when differences of nutrition are under analysis. On this point the Commission's Report is emphatic. The bearing of race on nutrition is considered in detail in Part II.

13. *Neck, Trunk, Limbs.*

The remaining measurements—neck, trunk, limbs—are all more or less relevant to school efficiency. In particular, the girth of the chest is of primary importance; of single measurements it is probably the best indicator of physical capacity. A study of the chapters on the circulatory system and the respiratory system will place this beyond doubt. In a very practical sense, a sound mind in a sound body means a sound heart in a sound chest. The importance placed by all the Services on the possession of a well-developed chest or a chest capable of good development is founded in good physiology. The whole nutrition of the body depends largely on two organs, the heart and the lungs. The development of the chest is a guide to the condition of both lungs and heart. Deformity of the chest may mean serious interference with the efficiency of heart and lungs, and, therefore, with the general efficiency for school life. Although, therefore, the importance of a sound chest can scarcely be exaggerated, the methods to secure chest development

are not always scientific. It must not be supposed that the necessity for good chest development justifies, without qualification, all the extreme methods of gymnastic and military drill. On the contrary, physiological development of the chest and its organs ought to be a perpetual check on the excesses almost inevitable when the extreme forms of physical exercise are in question.

14. *Forearm, Wrist, Ankle, Calf, &c.*

Some of the remaining measurements, such as the girth of the forearm, girth of wrist, girth of ankle, girth of calf, are fair indications of muscular development. The grasping power of the hand is a good physiological test both of muscular power and of tension. The other measurements, such as the width of pelvic crests, are more relevant to the matter of personal growth.

15. *Guide to Selection.*

In the selection of these measurements the investigators were guided by the details expounded in "Notes and Queries on Anthropology."* The observations were taken as nearly as possible in accordance with the directions given in that book.

16. *Teeth.*

The teeth have a very direct relation to school efficiency. In recent years the condition of the teeth in the population generally has excited a great deal of professional attention. Nor is this misplaced. It is found that the whole nutrition of the body depends both directly and indirectly on the condition of the teeth. It goes without saying that the capacity to masticate seriously affects the capacity to digest; but this is not the sole important fact. It has been found not only that decay of the teeth is, in part at least, the result of destructive microbes in the mouth,

* "Notes and Queries on Anthropology," edited for the British Association for the Advancement of Science by John George Garson, M.D., and Charles Hercules Read, F.S.A. London: Anthropological Institute. 1899. Price 5s.

but that some of these microbes are capable of affecting, directly or indirectly, the blood system, producing, it may be, anæmia or ailments of a vague, indefinable, yet substantial character. It is unnecessary to labour a point so well understood and so generally accepted. Accordingly, the condition of the teeth was ascertained with considerable exactitude. Cleanliness, daily brushing, development of permanent teeth, shape, regularity, number of decaying teeth, number of second-set lost, were all considered worthy of record. The degree of development of the permanent teeth is the only point likely to give rise to difficulty. In this matter the standards are somewhat variable, and the simplest method of securing a record that shall be of service to the expert is simply to record the number of permanent teeth visible above the gums. In the Aberdeen tables, as will be seen, this was done, and the results are of technical interest for the study of development. The regularity and shape of the teeth must be recorded as bearing rather on development than on nutrition; neither regularity nor shape can be said to have much relation to school efficiency. It has very frequently been pointed out that the shape and regularity of the teeth depend to a certain extent on development of the hard palate, and this has a certain significance as an index of brain development.

17. *Hair.*

In placing hair on the schedule, the investigators had no further intention than to take a good opportunity of recording an easily-recorded fact. Incidentally, however, the hair was found to be an index of nutrition. Rich, moist, glossy hair is found in one state of nutrition; sparse, dry, dull hair is found in another state of nutrition. Further, the condition of the hair as to cleanliness was usually included in the observation of cleanliness. The colour of the hair is to some extent an indication of race. Hair, however, cannot be considered either as a permanent mark of race or as a predominantly important index of nutrition. It is always an index of personal taste and domestic nurture.

18. *Eyes.*

The primary senses for school purposes are the eyes and ears. A matter so obvious needs no emphasis. The only practical question was to what extent the examination of eyes should proceed. The investigators, after discussing the matter with expert ophthalmic surgeons, concluded that no investigation worthy of the name could include less than the colour, colour perception, acuteness of sight as tested by reading, refraction as tested by retinoscopy, and diseases or deformities. Colour was not an important observation, but it was decided to take it on the same grounds as the colour of the hair. The standards guiding the observations were those known as "Galton's eyes." Colour perception, however, it was ultimately decided to discard. Colour perception in young children is an extremely difficult matter to estimate. Further, the field has been so well worked already, and so little of school work depends upon colour perception, that the investigators considered the necessary time and labour to be out of proportion to the purposes of the inquiry. With the acuteness of sight as tested by reading it was very different. The whole course of school life may be said to depend on the capacity to read. From the purely ophthalmic standpoint, however, the capacity to read is far from an exhaustive test. From the standpoint of school efficiency, the test is practically adequate. If a child cannot see at a distance suitable for reading, it necessarily suffers in educational progress. But the capacity to read may be present if a single eye is functional. Now, the intention of the Commission was merely to ascertain whether the child could read when both eyes were in use. So far as educational progress is concerned, it is immaterial whether only one eye is used or whether both eyes are functional. In practice, however, it is a simple matter to test each eye separately. And this ought always to be done. It has to be remembered that the requirements of school life do not exhaust the possibilities of the future. In the more delicate

manipulations incident to many mechanical occupations, the full use of both eyes is absolutely essential. With one functional eye, stereoscopic vision is impossible, and yet for many handicrafts stereoscopic vision is essential.

The reading test, however, is rarely an adequate optical test for children. Their capacity for accommodating the eye to differences of distance is so great that in many cases of hypermetropia the reading test may reveal no defect. A child may thus be suffering from serious optical defect without having its school efficiency for the moment impaired. At a later stage of school life, however, and almost certainly when the occupation comes to be chosen, such defects give trouble. Consequently, it was considered important that the eyes should be tested for defects of refraction. It was not intended that such defects as were discovered should be precisely measured, as they must be when correction is made. The intention was merely to reveal the presence or absence of a defect, and to give it its definite name. Accordingly, the inquiry covered hypermetropia, or long sight, myopia, or short sight, and astigmatism. For the discovery of these defects it is necessary to apply the method of retinoscopy. The essentials of this matter are detailed in the appropriate chapter. Each eye had to be tested separately, and each defect recorded. The defects discovered must be correlated with the results of the reading test. Only in this way could a true estimate be formed of the part that eye defects play in the intellectual progress of a child. It is well known, too, that even small defects of astigmatism produce headaches, and may thus indirectly interfere with progress.

19. *Ears.*

The ear, like the eye, is a primary sense. It was decided to test the keenness of the hearing and to examine the condition of the ears. As disease of the ear has important relations to disease of the throat, the inclusion of ears in the investigation for efficiency needs no further justification.

20. *Nose and Throat.*

The nose and throat are among the most fertile sources of school trouble. It was considered of primary importance to record the conditions of tonsils, of cervical glands, of pharynx, and of any obstructions, such as adenoids. It was decided also to test the sense of smell.

21. *Deformities.*

The presence of deformities is important for the study of degeneration. Deformities also have a bearing on physical culture. The Commission expressed a wish that details of deformities should be procured. As deformities may be divided roughly into congenital and acquired, this division was chosen. Congenital deformities include harelip, cleft-palate, and club-foot. These are indications of incomplete development, and are not unimportant in the study of heritable degeneration. Acquired deformities include flat-foot, knock-knee, and bowed legs. These are not unimportant in the study of nurture or environment; they may roughly be named evanescent or "generational" degeneration.

22. *Diseases.*

Eight classes of disease were investigated. These were —diseases of the skin, glands, bones, joints, heart, lungs, abdominal organs, and other diseases or injuries. The justification for this comprehensive selection will be found in the chapters where they are specifically dealt with. No investigation could have been regarded as reasonably complete if any of these classes of disease had been omitted.

23. *Residual Facts.*

Space was left on the schedule for such other observations as could not be conveniently recorded under any of the headings described.

We give below the items of the schedule. The spaces

have been obliterated; each investigator may arrange the headings in such tabular form as may suit his special purposes.

ROYAL COMMISSION ON PHYSICAL TRAINING (SCOTLAND).

Edinburgh.—Name of school, age-group, sex; session began; date of medical examination, 1902.

No. or name, date of birth, age (years and months), residence, No. of rooms, father's occupation.

School standard in which studying, position in class during last term, number of pupils in class during same term. Has position been improving? Teacher's opinion of mental capacity —E., excellent; G., good; M., medium; D., dull; Def., defective. Regularity of school attendance—if absences 8 per cent. or under, good (G.); if above 8 per cent., but under 16 per cent., medium (M.); if above 16 per cent., bad (B.); cause of irregularity. Has attendance been improving?

Physical Exercise.—Forms of systematised exercise, if any; daily duration; years practised; outdoor games (kind and amount); other forms of exercise.

Personal Appearance.—Complexion—pale (P.), medium (M.), ruddy (Ry.); health appearance—good (G.), medium (M.), bad (B.); state of nutrition—stout (S.), medium (M.), thin (T.), ; brightness and alertness—good (G.), medium (M.), bad (B.); carriage and general balance—good (G.), medium (M.), bad (B.).

Cleanliness.—Good (G.), medium (M.), bad (B.); 1. Clothing; 2. Body. (Only such uncleanliness to be considered as is due to absence of proper habits and reasonable care.)

Measurements.—Weight (with usual indoor clothing, but without boots and stockings), lbs.; height standing (without boots and stockings), centimetres; height sitting (vertex to buttocks, thighs closed and horizontal), cms.; head—(*a*) greatest length (glabella to occiput), cms.; (*b*) greatest width (above level of ears), cms.; (*c*) minimum width of forehead (between lateral ridges of frontal bone), cms.; (*d*) height (vertex to centre of tragus—head erect), cms.; (*e*) greatest circumference (level of glabella), cms.; (*f*) contour irregularities. Neck—minimum circumference (head erect), cms.; trunk (without clothing)—(*a*) girth of chest (immediately above nipples and over scapulæ, arms hanging; average of measurement during inspiration and expiration), cms.; chest deformity; (*b*) width of shoulders (be-

tween tips), cms.; (*c*) greatest width of pelvic crests, cms.; (*d*) greatest width of hips (at head, great trochanter, of thigh bones; standing, feet close), cms.; limbs (without clothing)—(*a*) greatest girth of forearm, cms.; (*b*) least girth of wrist (hand open), cms.; (*c*) greatest girth of right calf (standing), cms.; (*d*) least girth of ankle (standing), cms.; (*e*) grasping power of hand—(1) right hand, lbs.; (2) left hand, lbs.

Teeth.—(*a*) Cleanliness—good (G.), medium (M.), bad (B.); (*b*) are they brushed daily? Shape of teeth—good (G.), medium (M.), bad (B.); (*c*) degree of development of permanent teeth; (*d*) regularity—regular (R.), medium (M.), irregular (I.); (*e*) number of decaying teeth—(1) first set, (2) second set; (*f*) number of second set lost.

Hair.—Colour—black and dark brown (B.), medium or chestnut-brown (M.), fair (F.), red (all shades) (R.).

Eyes.—(*a*) Colour—dark (D.), medium (M.), light (1) all blues (L.B.), (2) other than blue (L.O.); (*b*) Colour perception—normal (N.), defective (D.), stating colours in which defective; (*c*) acuteness of sight (smallest Snellen's type read at 6 metres, using both eyes); (*d*) refraction of eyes—hypermetropia (H.), myopia (M.), astigmatism (A.); (*e*) disease or deformity of eyes or eye-lids.

Ears.—(*a*) Keenness of hearing (extreme distance at which watch heard)—the normal distance being—(1) right ear, ft., (2) left ear, ft.; (*b*) disease of ears.

Nose and Throat.—(*a*) Disease (*e.g.*, enlarged tonsils and cervical glands, adenoids); (*b*) sense of smell.

Deformities.—1, Congenital (*e.g.*, harelip, cleft-palate, club-foot); 2, acquired (*e.g.*, flat-foot, knock-knee, bowed legs).

Diseases.—1, Skin (*e.g.*, eczema, scabies, tinea); 2, glands; 3, bones (*e.g.* rickets, tubercle, caries); 4, joints (*e.g.*, rickets, tubercle, caries, stiffness); 5, heart (including pulse); 6, lungs; 7, abdominal organs [*e.g.*, tabes, hernia (umbilical, inguinal, or femoral)]; 8, other diseases or injuries.

Other observations (*e.g.*, feeding, clothing).

N.B.—Where it is desired to express the degree of any condition, further than is indicated in the schedule, the three grades, 1°, 2°, 3°, may be used.

CHAPTER III.

The Form of Medical Inspection, continued.

B. *Revised Schedules for Routine and Special Medical Inspections.*

1. *Introductory.*

So far, the schedule used for the Royal Commission's particular investigation. It is obvious that, while for the specific purposes of the Commission a very elaborate schedule was necessary, the ultimate objects of a medical inspection of schools might be served by something less elaborate. At least, it has to be allowed that schools vary; that not in every instance will the facts of primary importance to the children take the precise form here presented, and that local modifications will be met sometimes by a less and sometimes by a more elaborate examination. The main purpose of the Commission was to establish, as it were, a "first case," clear and convincing, for a medical inspection of children attending State schools in Scotland.

Let us assume for the moment that such a clear case has been established. We shall now consider in detail how the contemplated inspection shall be carried out. It is one thing to gather data to prove the desirability of instituting an inspection; it is another thing to devise the form that shall make such an inspection at once easy and systematic. But the data collected for the one purpose are not without value for the other. They indicate at the least what can be done within reasonable limits of school-time; what kind of facts are to be looked for; what methods lend themselves most readily to the collection of materials without excessive waste of time. At

first sight, the Royal Commission's schedule appears forbidding because of its elaboration; but, more closely examined, it will be found to be rather a code of guidance for the examination than an unalterable scheme for recording facts. Much of the schedule obviously is what every practical observer would spontaneously consider if he were asked to determine the fitness or unfitness of a child for school-work. The mere number of items on the schedule should, therefore, not act as a deterrent to its use; they should, on the contrary, be accepted as a convenient guide. The data accumulated, which are abundantly illustrated in this volume, themselves constitute the result of the medical inspections of ten schools. That they were of the order desired by the Commission is shown by the fact that the Commission gave to them the full weight of its authority and approval. Consequently, if, in the schedule now to be considered, we retain the great majority of the items in the Commission's schedule, it will be because, from our detailed experience, we regard the majority of these items as indispensable for a thorough medical inspection. But, in order to economise labour and time, we have to a certain extent re-classified the items of the schedule; we have embodied in the larger schedule the details absolutely indispensable to all full medical inspections; we have relegated to smaller, special schedules certain items that could not be entertained in every school, but might well constitute special investigations where the staff and the time are available. In this way we shall hope to be of some assistance to medical inspectors in their efforts to design a system applicable to particular schools or particular localities. There remains one thing to add—The general data before the Royal Commission had already persuaded them that a medical inspection of schools was, from many standpoints, eminently desirable; the data accumulated in the special investigations revealed the matter as one of urgency. Not from the standpoint of military fitness alone, nor yet from the standpoint of industrial endurance, but from the standpoint of educable

capacity is the medical inspection of school children seen to be of primary importance to the commonwealth. In urging that each school should have access to medical advice, the Commission made the smallest recommendation consistent with any pretence to efficiency; in recommending that medical inspection should link itself to the great public health organisations, they lay down a fruitful principle of organisation; in collating masses of old and new facts for an estimate of physical capacity, they have offered us guidance for a routine practice.

2. *Objects of Routine Inspection.*

We shall now consider how much of the schedule ought to be retained for the general routine purposes of systematic medical inspection of schools; how much may safely be set aside; what other forms should be introduced, and what other forms may be necessary for the recording, registering, and tabulating of observations.

The ultimate object of systematic inspection is to eliminate from the schools all those unfit to profit by the education given there; to discover all those unfit to proceed at the standard pace; to enable the teacher to arrive at a classification strictly in accord with intelligence and staying power; thus to make it possible for the feeble children to receive special treatment and for the vigorous children to have the advantage of their vigour; to point out the remedy for defects when defects are remediable; to point out the danger from defective organs; to guide the teacher in the selection of methods of physical training; to test its effects from time to time; to devise methods of training applicable to the physically enfeebled or defective; to scrutinise the children for every form of epidemic disease, specific or parasitic; to direct the measures advisable in every case of disease discovered, whether it be defective vision, defective hearing, enlarged tonsils, nasal obstructions, or any other defect, deformity, or disease; and, generally, to discover, prevent, or remedy all such diseases, deformities, or defects as may impair

school efficiency and may be capable of remedy or mitigation.

3. *Construction of Schedule.*

The principles expounded in the previous chapter are, with the differences indicated, applicable to the construction of the present schedule. School efficiency, as repeatedly pointed out, includes capacity for physical as well as mental education. But many of the items must concern both.

(*a*) *Identification, &c.*—All that is involved in the identification of the child, in his social grade, in his personal occupation outside school hours, in his school standard, in his physical exercise, in his personal appearance and healthiness, in his cleanliness, is equally essential to an intelligent estimate either of physical education or of mental education. It is obvious that, however we may wish to curtail the time expended in the examination, none of these items can be well dropped from the schedule. Fortunately, however, they can, as is separately shown, be ascertained by the teacher of each class without sensible increase of work. In every well-conducted school they are, indeed, habitually ascertained by the teacher. They are not in the strict sense medical; but they are indispensable to a medical estimate of fitness. Accordingly, they must be included in the routine inspection schedule.

(*b*) *Measurements.*—Equally indispensable are certain measurements. Here, however, we must make some compromise, and the compromise must rest on what is necessary and practicable within the conditions of the Code. Medical inspection must not seriously disturb or add to the work of the school. Important as health inspection is, and, from the purely scientific standpoint, interesting as it is, it must be kept strictly subordinate to its aim, the increase of school efficiency. In practice, medical inspection will never be liable to exceed those limits, for the amount of detail absolutely indispensable will always obviate any temptation to collect irrelevant

or unimportant facts. As in every service, the tendency rather will be to discard everything that is not essential to a reasonable scrutiny.

For what school purposes, then, are any measurements essential?

To answer this in general, it has to be stated that one likely result of the Commission's report and recommendations will be that the Central Education Department and the local education authorities will continue to give increased attention to physical culture. By this we do not mean physical culture in the restricted sense of physical drill, but in the broad sense, which includes the general nutrition of the body, the soundness of the great systems—circulatory, respiratory, alimentary, integumentary, nervous, &c.; the soundness of the special senses, the capacity for physical development, the general balance of mental and physical, the response of the child to school environment, the feeding, the cleansing, the clothing, in a word, the nurture of the child. Now, as we have shown generally in the discussion of the previous schedule, the test of physique in this wide sense involves at least two measurements—height and weight. These cannot be omitted from any health inspection. They are fundamental; they are understood everywhere; they can be made with few appliances and very little labour. Their value as an index of nutrition and development will be fully set forth in a subsequent chapter. They are the least that can be required of any medical inspector of any school, urban or rural.

Of the other leading measurements, one is of outstanding importance—the girth of the chest. This also must be included. The justification for its inclusion has been already set forth.

Of the remaining measurements the majority are relevant less to health than to special physical training. As a test of physical progress, of improving muscle, the measurements of upper arm, of forearm, of wrist, of calf, of ankle have their place; but they are matters more for the gymnastic instructor than for the teacher proper.

Even as an evidence of training, muscle-measurement is not free from fallacy. Mere increase of local muscle may mean under-development of other regions or organs. Even a superficial acquaintance with the movement, which always involves groups of muscles, will show that the pet muscles of the gymnasium may be a very fallacious test of physical capacity. Even for training, fat may be as important as muscle; for the general work of school, muscle and nerve must go together. These generalities we refer to here merely to point the proposition that muscle-measurement in general should be reserved for a schedule specially devised from the standpoint of physical training in the more limited sense. Occasionally, the medical inspector must direct attention to physical training; he must be prepared to assign values to progress in muscular development; he will have a definite interest in watching the effect of muscular training on the organism as a whole. Consequently, although a supplementary schedule devised from this special standpoint may not be primarily medical, it cannot be ultimately valued without medical assistance. Indeed, as the facts abundantly prove, medical supervision in the muscular drill-room is even more necessary than in the school-room. But as the order of training implied can be offered only to a limited number in any particular school, the scheduling of muscle-measurements on any elaborate scale cannot properly be included in the larger or school-room schedule. For these reasons, we have relegated such measurements to a special schedule, which may be used as occasion requires.

The other measurements in the Commission's schedule —head, neck, shoulders, &c.—have little direct relation to school health. The head measurements, however, are, given proper instruments, easily taken, and they afford anthropological material of the highest value. Nevertheless, we hesitate to recommend that the ordinary health-inspection schedule should be burdened with head measurements. These also, along with some others, we relegate to a supplementary schedule. Anthropological

work proper to a medical inspection is apt to be of little value in the promotion of science. The specialists in anthropology are never at a loss for new material; the methods of measurement and investigation are becoming more and more elaborate; and we think it right to restrict the purely anthropometrical measurements to a subordinate place. They should be the concern of a central department of specialists, who should constitute a bureau for the scientific organisation of all the data that bear on the progress of national physique.

(*c*) *Other Items.*—Of all the other items in the Commission's schedule it is difficult to omit any, except the colour of the hair and the examination for colour blindness. Any medical inspector will add what items may interest himself particularly. The conditions of school efficiency remain on the whole the same everywhere. The items specified in the schedule appended do not exhaust, but they fairly represent, the prominent features of school life in the State schools of Scotland. Any schedule should provide for local variations. Our purpose is to offer a form that shall be at once comprehensive enough for all routine inspections, and specific enough for such detailed investigations as circumstances may suggest. (For schedules, see Appendix.)

CHAPTER IV.

What the Teacher can do to Assist in Medical Inspection.

1. *Introductory.*

From the most casual study of the schedule, it is obvious that many of the observations, although they afford data for medical consideration and inference, are not themselves specifically medical. It is also obvious that, in the more strictly medical sections of the schedule, there are many observations that can be recorded without the presence of a medical practitioner. Since, for the purposes of organisation and administration, it is of the highest importance at once to accumulate the greatest number of precisely defined facts and at the same time not to overload any single official with the work of recording, it will be profitable to consider in detail, first, how much the teacher may himself be expected to do, and, second, what he might without difficulty do under the special instructions and directions of a qualified medical inspector. If it be possible—and we think it is possible—for the teacher, without any serious interruption of his ordinary duties, to fill in a considerable part of the schedule, the natural difficulties of organising a medical inspection will be reduced to a vanishing quantity. It is not intended that the teacher should become responsible for any judgments on the health or unhealthiness of any particular child. It is rather intended that, in certain objective matters which may, to the mind of a medical man, suggest health or unhealthiness, and are easily observable or measurable, the teacher should assist. In the purely medical sections it is also intended that the teacher, who

is necessarily more familiar both with the family history and the personal conduct of the pupil, should habitually note any signs or symptoms that may enable the medical inspector to select the first children for examination. Without some practical experience of children, no teacher can be expected to assist in this way; but in each chapter dealing with the detailed examination of conditions, we shall indicate what to record and what to bring under the immediate notice of the medical inspector. Meanwhile, we shall bring together a few such leading points.

2. *Assistance with Non-Medical Sections.*

As we have already indicated in describing the schedule, all the details concerning the name, age, residence, school-standard, and physical exercise of the pupil fall primarily to the teacher, who already will have recorded, with very few exceptions, almost all that is required. For the purpose of medical inspection, therefore, all that is needed is simply a transcript of facts already within the teacher's knowledge. These facts are accumulated piecemeal in the course of school registration; they may be entered in the medical inspection schedule in the same piecemeal fashion, and thus the labour of recording may be so diffused that it shall involve no appreciable increase in clerical duty. The precise value to be attached to the items here referred to has already been explained.

3. *Personal Appearance.*

This section of the schedule, although referring to things apparently simple and obvious, implies careful personal judgment of health and disease. The estimate that a teacher might put on a pale complexion would not be based on the same grounds as the estimate of a medical inspector. Similarly, with the state of nutrition, brightness and alertness, carriage or deportment. As is shown, however, in the appropriate place, the teacher may prepare the way for the medical inspector by a preliminary classification according to complexion, brightness and

alertness, &c. This section as a whole should be essentially the work of a medical inspector or some observer specially trained under his direction. "Personal appearance" is the occasion of first contact between medical inspector and medically inspected.

4. *Cleanliness.*

This is a matter that might well be recorded by the teacher, who, in a certain degree, is responsible for the cleanliness of every child. At the same time, the observation of cleanliness is most easily made when the examination of heart and lungs is being carried out, and as without such examination of the body, the appearances of cleanliness are sometimes deceptive, this section is, as a rule, best left to the medical inspector. In the worst cases, no doubt, the teacher is always well informed as to the condition both of clothing and body. The necessity for recording this condition will act as a stimulus both to teacher and pupil to maintain the greatest cleanliness possible; it will increase the responsibility of the teacher, and his observation will always be open to revisal in the course of the subsequent examination. Accordingly, if, in this section, the teacher is made responsible for the record, he should not be requested to give a final opinion. The children should be scrutinised independently by the medical inspector, who will be guided by the general character of the school.

5. *Measurements.*

In the schedule as adapted to school inspection, we have re-classified the items of the Commission's schedule. Our purpose in this is to facilitate the work of recording. Of the whole measurements, three are of primary importance for the estimation of nutrition, namely, weight, height, and girth of chest. These three measurements every teacher is able to take accurately and to record. If a suitable weighing machine is provided and detailed tests prescribed to ensure that it shall be accurately justified before each use, the taking of weights presents no difficulty.

If, in like manner, an appropriate height-measurer is provided either with the weighing machine or in separate form, the measurement of height presents no difficulty. Both these measurements may be taken by the teacher, and should be verified by the medical inspector on a number of children selected by lot. Similarly, with the girth of the chest. The only point of importance here is the level for placing the tape-line. Once this is understood and the variations during inspiration and expiration fully illustrated, no teacher should have any difficulty in taking and recording the measurement.

6. *Measurements for Muscular Development.*

The measurements for muscular development include certain measurements of neck, trunk, and limbs. These are well understood as a necessary accessory to all the leading systems of physical training. In any of the schools where either the teacher or a special drill-instructor has charge of the physical training, he may, without difficulty, take these measurements from time to time. But as they are not of primary importance for medical purposes, they should not be required as a routine duty either of the medical inspector or of the teacher. The handbooks on physical training afford abundant information on the growth of physical development as the result of training; the specific interest of any teacher of physical training or any drill-instructor may be trusted to ensure that such measurements will not be neglected; and, since special grants are given where physical training is organised, these measurements, which are apparently so elaborate, will probably be among the most carefully taken.

7. *Other Measurements.*

The measurements of the head, as well as some of the skeletal measurements of the trunk, such as width of shoulders, width of pelvic crests, are essentially anthropometrical measurements. They should not be required as a matter of routine duty. They might well form part of a complete schedule, but it should be entirely in the

option of the medical inspector or teacher to take them or not. The growth of the skull does not in any direct way depend upon physical training; its relation to health conditions is also indirect and exceptional, and it is not, therefore, in any special sense a medical measurement. If, in special circumstances, it is considered desirable to measure the skull, the three measurements required—greatest length, greatest breadth, and greatest depth—may be taken by the teacher. It has to be added, however, that these measurements must be taken with special instruments; they imply great care and delicacy, and they are liable to be rendered almost valueless by the neglect of apparently simple precautions.

8. *Dynamometry.*

One measurement in the Commission's schedule—the grasping power of the hand—is a physiological measurement. It is of decided value as a test of neuro-muscular effort. With the apparatus devised by Professor Hay, or even, in the case of older children, with the ordinary dynamometer, the measurement is perfectly simple and easy. It may without difficulty be taken by the teacher. It involves very little expenditure of time.

9. *Teeth.*

As already indicated, the condition of the teeth is of primary importance in the estimate of nutrition. It is not difficult to observe the number of decayed teeth in a child's mouth; but to estimate the degree of development calls for delicacy of observation and discrimination. The seriousness of a decayed tooth depends largely on whether the tooth belongs to the first set or to the second set, and in reality the matter is one for an expert. We consider that the teacher cannot be expected either to examine the child's teeth himself or to render much assistance. He will, as a matter of school-room manners, inculcate the necessity for clean teeth and persistent and daily attention to them.

10. *Hair.*

The colour of the hair is of interest only as a matter of

anthropology. It may be left entirely to the teacher, if indeed it be required for the record at all.

11. *Eyes.*

The teacher may record the colour of the eyes. He may be asked to estimate colour-perception, which even in skilled hands is a matter of considerable difficulty. He ought to be instructed in the use of Snellen's types both for near distance and for long distance. For details in their use, we refer to the chapter on the examination of the eye. We have there indicated what precise points the teacher should be able to ascertain. The refraction of the eye the teacher cannot be expected to estimate. As to disease and deformity, he may assist by drawing attention to all cases of inflamed lids, inflamed eyes, or "sore eyes," or squints. In this way he may seriously economise the time necessary for a complete examination of the eye. With a little experience in the use of the reading test, he may learn how to classify his children according to their visual acuteness.

12. *Ears.*

From the ordinary work of any class, the teacher rapidly discovers whether the child's hearing is normal or abnormal. He is in a good position at any time to apply the "speaking test." With a little practical experience he should be able to put the speaking test in a quantitative form. He ought to be able to judge which ear is seriously affected or whether both ears are affected. The teacher, indeed, is frequently able to apply this test with greater precision than the school conditions as a whole readily allow, for he has the children in a special class-room, under his own control, and, from previous experience of the child's replies, he knows how much to assign to want of attention and how much to deficiency of hearing. The "watch test" would involve a little more care, but it implies no difficulty that any intelligent teacher might not, with some experience, overcome. The details of both tests are referred to in the chapter on the examination of the ears.

13. *Nose and Throat.*

The conditions of nose and throat are a matter for the careful consideration of the medical inspector. But the teacher may assist by noting certain symptoms. These are specified in the appropriate place.

14. *Deformities.*

The grosser deformities might well be recorded by the teacher, but the minor deformities of the same class sometimes require a good deal of careful attention in the light of medical knowledge. Cases of marked harelip are too obvious not to be observed by every one; similarly with marked cases of club-foot. Cleft-palate is different. It may vary from a condition so serious as to make the speech almost inarticulate to a condition so slight as to be of no consequence. All three classes of deformity, however, are relatively uncommon, and may well be left to the medical inspector alone. Of the acquired deformities, such as flat-foot, knock-knee, bowed-legs, some are very obvious and some are very slight. They, on the same grounds, should be left to the medical inspector.

15. *Diseases.*

How far the teacher may assist in a preliminary survey of the signs and symptoms of each class of disease is set forth in the appropriate chapters.

16. *Conclusion.*

From this summary it appears that the teacher may, without imperilling the medical value of the observations or loading too much the routine class-work, undertake the recording of about one-third of the schedule. It is to be remembered that in any cases of doubt or difficulty he has access to the advice and direction of the medical inspector.

CHAPTER V.

The Existing Powers for Medical Inspection of School Children.

1. *Powers of Public Health Authorities.*

The local authorities for public health and their officers have certain statutory duties in relation to schools and school-children. This fact to some extent determines in what direction a medical inspection of schools shall be developed. As a matter of economy in organisation, the public health system must be definitely related to the educational system. It is a commonplace of public health knowledge that in the diffusion of infectious diseases schools play a leading part. The reason lies on the surface. The school is an aggregate of the most susceptible materials. At the admission age, the school child has not, as a rule, attained his "possible" of infections. The proportion of children as yet unselected by infection is large. Accordingly, the infections at school are placed under the most stringent regulations. But the growing infant is susceptible to influences less gross than infection. He responds to the most subtle forms of insanitation. Accordingly, the sanitary control of schools continues to increase in stringency. Further, the list of general and specific diseases associated with defects in the environment continues to grow. Accordingly, the interest in the individual health of the child is not limited to the infections. For these and similar reasons, the present public health organisation offers at once a basis and a model for the extended medical inspection of individual children now contemplated.

Let us look at the powers already in force.

2. *Examination of School Children for Infection.*

By section 45 of the Public Health (Scotland) Act, 1897, "The medical officer may at reasonable times in the day-time enter and inspect any house or premises in the district in which he has reason to believe that any infectious disease exists or has recently existed, and the medical officer may examine any person found on such premises with a view to ascertaining whether such person is suffering or has recently suffered from any infectious disease."

By section 3 of the same Act, "The word *house* means dwelling-house, and includes schools."

Accordingly, it is clear that a medical officer of health already possesses full powers of entry into the schools and of examination of school children when he suspects infectious disease.

3. *Control of School Attendance.*

But, for the suppression of infectious disease, these powers are not sufficient. Section 57 of the Act is as follows:—

"*Penalty on Sending Child to School so as to Spread Infection.*—Every parent or person having care or charge of a child who is or has been suffering from infectious disease, or who resides in a house where such disease exists or has existed within a period of three months, who shall knowingly or negligently permit such child to attend school without procuring and producing to the teacher or other person in charge of such school a certificate from the medical officer, which he shall grant free of charge, or from some legally-qualified medical practitioner, that such child has become free from disease and infection, and that the house and everything therein exposed to infection has been disinfected to the satisfaction of such medical officer or medical practitioner, shall be liable to a penalty not exceeding forty shillings.

"Provided that if a person is not required to send

notice in the first instance, but only in default of some other person, he shall not be liable to any penalty, if he satisfies the Court that he had reasonable cause to suppose that the notice had been duly sent.

"Any teacher or person in charge of any school who shall knowingly permit any child to attend such school in contravention of the provisions of this section shall be liable to a penalty not exceeding forty shillings."

This section is more comprehensive than section 45, in that it covers the case of children not themselves infectious, but exposed to infection, and, therefore, liable to convey it elsewhere. The clause includes:—"Every parent or person having care or charge of a child who is or has been suffering from infectious disease or who resides in a house where such disease exists or has existed within a period of three months." In actual operation this clause is very drastic, and has created not a little difficulty for school boards.

In the counties of Scotland, it has been found extremely difficult for the medical officer of health of the district to place himself at the disposal of school boards for the purpose of this section. Even the notified diseases are more than the medical officer can personally attend to. When to these are added the non-notified diseases, such as, in most localities, whooping-cough, measles, chicken-pox, and others, still less can the medical officer of health be expected in all cases to grant certificates. Accordingly, in some counties an arrangement has been made whereby the private medical practitioners are paid a small fee for granting such certificates as may be required either in the case of notified or in the case of non-notified diseases.

In the towns, the system has been variously organised. In general it may be said that it works without difficulty and without friction. The medical officer of health systematically informs the school boards or the school-masters of the diseases notified. In some towns it is found more convenient to intimate the cases to the school board office, the attendance officers distributing the notices to

the headmasters with less delay than the ordinary postal service would involve. This makes it unnecessary for the medical officer of health to discover the child's school before the intimation is issued to the board. In the larger cities—for example, Glasgow—the intimations are sent direct to the headmasters. And where an adequate staff of inquiry officers is available this is the best method. Our point is that, in counties, the difficulties are considerable; in towns, they are a vanishing quantity.

The section, it will be observed, places an obligation on the parent and on the teacher. The one cannot send the child to school, the other cannot receive him there, without the necessary certificate. And the certificate involves a compound obligation. It must bear that the child is free from disease and infection, and that the house and all the exposed articles have been disinfected. There are thus created by the clause four distinct obligations. Let us see how they may be fulfilled.

The first two—the obligations of the parent and the teacher—are easily discharged.

The easiest obligation of the four is the obligation of the teacher, who has only to refuse admission unless the necessary certificate is produced. The difficulties begin when the parent's obligation has to be discharged. Here there are several possibilities. The child may have suffered from a notifiable disease. In that case, the medical attendant has notified the fact to the medical officer of health in the way provided by the Infectious Disease (Notification) Act, 1889. When the child recovers, the medical attendant may certify him free from disease and infection; the medical officer of health will, when he is satisfied, certify the house and the articles free from infection; the certificates may be presented separately or together, or may be combined into one by the medical officer of health and transmitted to the teacher. The case is then closed.

But if the medical attendant, as occasionally must happen, does not certify the child free from disease or infection, the medical officer of health has no definite

information to justify his undertaking the disinfection of the house and articles. It would be fruitless to disinfect a house if the patient is still infectious. The medical officer of health must then investigate the case directly by an examination of the child. This action is provided for by section 45. When he has satisfied himself that the child is free from infection, he disinfects the house, and the compound certificate is then filled in by him and transmitted to the teacher or parent.

In connection with the notifiable diseases, it is usually possible to get a certificate first from the medical attendant that the patient is free of infection. In some counties, where the number of cases is great or the distances are such as to involve serious outlay, the local authority of the district has arranged to pay the medical attendant a fee for his certificate. The rest is concluded by the medical officer of health. As a rule, the certificate is given as a sequel to the notification without further fee. But there always remains the case where no medical attendant has been called. Here the medical officer has obviously the primary responsibility, and the examination and certification of such cases form a clear part of his duty. At least, he should be prepared to advise some arrangement either for his own discharge of this duty or for the procuring of the necessary local assistance. Every inquiry into a local outbreak of infectious disease may reveal cases that had not come under the treatment of any doctor, and it is the duty of the local authority to deal with these, and consequently it is for the medical officer of health to see the statutory certificates adjusted.

To show how these administrative difficulties have been met, we give the deliverance of the Local Government Board for Scotland:—

As to the Interpretation of Section 57 of the Public Health (Scotland) Act, 1897.

Local Government Board,
Edinburgh, 7th July, 1898.

Sir,—Within the past few months the Board have been

frequently asked for their opinion and advice as to the interpretation of section 57 of the Public Health (Scotland) Act, 1897, and the respective obligations of local authorities and school boards in connection therewith; they therefore deem it advisable to draw the attention of local authorities generally to this important subject.

There appears to be a general impression that the provisions of section 57 as to the prohibition of children from attending school who are or have been suffering from infectious disease or who reside in a house where such disease exists or has existed within a period of three months, apply only to the diseases specified in the Infectious Disease (Notification) Act, 1889. These diseases are smallpox, cholera, diphtheria, membranous croup, erysipelas, scarlatina or scarlet fever, and the fevers known as typhus, typhoid, enteric, relapsing, continued, and puerperal. In the opinion of the Board the section applies, but is not limited, to the above-named diseases. The Board hold that the section extends to infectious diseases generally and that measles and whooping-cough, for example, are infectious diseases within the meaning of section 57. The fact that these two diseases are not expressly named in the said Act of 1889 does not, in the opinion of the Board, affect the procedure under the Public Health Act.

As regards the procedure to be followed by local authorities in administering this section, the Board do not anticipate any difficulty with regard to the notifiable diseases. When a notification is received inquiry should be made, and, if it be found that any child in the infected house is attending school, the attention of the parent or guardian should be directed to the provisions of section 57 and intimation of the case should be given to the clerk to the school board or to the head teacher of the school.

It is evident that information cannot be afforded with the same completeness in the case of non-notifiable diseases, but, when there is reason to believe that such cases exist in the district, the local authority should intimate to the school board or to the teachers any cases which may come to their knowledge. They should also, by means of handbills, issue a warning that children who are or have been suffering from infectious disease must not be allowed to attend school until they can produce to the teacher a certificate that they are free from infection,

and that the house, &c., has been disinfected to the satisfaction of the medical officer of health or of a medical practitioner.

The local authority should explain that the certificate may be given by any legally qualified medical practitioner, and also that the medical officer of health (giving his name and address), if acquainted with the facts of the case, will grant such certificate free of charge.

The handbills should further state that all persons contravening the aforesaid statutory provisions are liable to a penalty not exceeding forty shillings.

I am,
Sir,
Your obedient Servant,
G. Falconar-Stewart, *Secretary.*

The Clerk to the
Local Authority.

In the counties the circumstances are sometimes peculiarly difficult. In a reply to an inquiry by a county and district medical officer of health, the Board gave their opinion of the extent and nature of the duties imposed by this clause on the medical officer of health.

Local Government Board,
Edinburgh, 20th February, 1899.

Sir,—I have submitted to the Board your further letter of 8th instant regarding the interpretation of section 57 of the Public Health Act of 1897.

In the opinion of the Board the two subjects of certification under the above section, viz., (1) as regards the person of the child, and (2) as regards the house and things therein must be
child, and (2) as regards the house and things therein, must be
discriminated in respect thereof—

(1) Implies a personal examination of the child and the possibility of giving a certificate depends upon the condition observed at the time. The child may still be in an infectious state. It may have all the appearance of health. It may never have had the alleged disease at all. The medical officer of health may be entirely dependent on the statements made to him.

(2) In any well-ordered sanitary administration, where the sanitary inspector or other competent officer takes his instructions direct from the medical officer of health and acts as his agent, the medical officer of health might safely certify that disinfection had been carried out to his satisfaction, when carried out by the sanitary inspector under his instructions.

The question, therefore, is entirely one in connection with the certificate as regards the person of the child, and I am directed to reply to your queries as follows:—

(*a*) As to the school board, the obligation to produce the certificate rests upon the parent, and with the parent alone has the school board to deal.

(*b*) With regard to this query the penultimate sentence of the Board's circular of 7th July last (copy enclosed) covers the whole case. It is not to be supposed that because the medical officer of health, "if acquainted with the facts of the case," and, therefore, in a position to certify, is required to certify for nothing, *therefore for the purpose of getting a certificate for nothing*, a parent can compel the medical officer of health to go and examine his child and give a certificate. Moreover, he may examine and, as explained, may still be unable to certify.

(*c*) The medical officer of health must take a liberal view of the case. If by any means or accident he has become sufficiently "acquainted with the facts to certify" then he would be well advised to do so.

The Board would recommend local authorities to append to "the handbills" referred to in the Board's circular a note to the effect that in view of their obligations under section 57, parents and guardians are advised to send for their medical attendant at once that he may be able to give the necessary certificate. If no medical man has seen the child when the disease can be recognised it may be impossible to procure a certificate after recovery.

In view of the importance of the prevention of the dissemination of disease by schools, local authorities, and especially district committees, would be well advised to make some standing arrangement by which, when the medical officer of health thinks it would be in the public interest to examine for the purpose of certifying, he should be authorised, if unable to do so himself,

to retain the services of a convenient medical practitioner, preferably the usual attendant, at a fixed fee. It is very desirable that the medical officer's official time should be preserved from the inroads of such work in county districts.

I am,

Sir,

Your obedient Servant,

G. Falconar-Stewart, *Secretary.*

4. *Other Sections applicable to Schools.*

The sections already discussed are specifically adjusted to the inspection of schools and school children. But the Act contains certain general sections, which apply to schools not less than to other premises. We refer only to those sections that affect the administrative side of school work, and, therefore, are of direct importance to school children.

Section 40.—*Houses in a Filthy State to be Purified.*—Normally, this section applies to ordinary dwelling-houses, but the term "house" includes "school," and there appears to be no reason why, in special cases, a dirty school may not be treated as a "filthy house." Usually, the need for cleansing arises out of the need for disinfecting, and these are covered by another section (sec. 47); but filthiness and infection do not always co-exist, and, consequently, section 40 may be occasionally convenient.

"Where it appears to any local authority that any house or part thereof, or any article of bedding or clothing therein, is in such a filthy or unwholesome condition that the health of any person is affected or endangered thereby, or that the whitewashing, cleansing, or purifying of any house or part thereof, or any article of bedding or clothing therein, would tend to prevent or check infectious disease, the local authority shall give notice in writing to the owner or occupier of such house or part thereof to whitewash, cleanse, or purify the same, or any such article as the case may require." If the cleansing is not carried out as

required, the local authority may execute the necessary processes and recover the expense.

Sections 46 *and* 47.—*Provision of Means for Disinfecting Bedding.*—The disinfection of schools and all school appliances, furnishings, &c., is completely provided for by sections 46 and 47.

By section 46, the local authority may, and, when required by the Local Government Board, must provide all the appliances and service necessary for disinfecting "articles (whether bedding, clothing, or other) which have become infected by any infectious disease." These articles may be removed from the school for disinfection, and returned. They may, when necessary, be destroyed. All this the local authority is under obligation to do "free of charge." Local authorities may combine for the purposes of this section.

Under section 47, the school premises may be disinfected. The condition to be first fulfilled is this—The medical officer of health, or any other legally qualified medical practitioner, certifies that "the cleansing and disinfecting of any house, or part thereof, and of any articles likely to retain infection, or the destruction of such articles, would tend to prevent or check any infectious disease."

This pre-supposes the existence of some infection that affects the school children. It does not necessarily involve the existence of demonstrable infection in the school itself. In several of the infections, practically in all, the only proof that they infect a school is that the children are affected. Consequently, the occurrence and recurrence of infection among school children constitute good grounds for applying the powers of this section. The application of the powers may involve the closing of the school, and this is provided for under the Education Code. The special circumstances of each locality will indicate to the medical officer of health when he ought to recommend the enforcing of this section. As a rule, the school managers are under strong inducements to make and to

keep the school free of infection, and, therefore, difficulties are rarely placed in the way of the public health officer. As, however, school administration cannot produce its best results when interruptions are frequent or long, it is reasonable that the medical officer of health should adopt the most rapid and simplest methods consistent with effective disinfection. Nor will cleansing and disinfection always be necessary at the same time. The primary object of the medical officer of health, acting for the local authority, is to make the school a safe place for the children. To him, cleansing in the sense of the removal of non-infective dirt, is of secondary importance for any particular infection. It is, however, on other grounds of primary importance to the school managers. Consequently, it is usually a routine sequel to disinfection.

Section 56 imposes a penalty on exposure of infected persons or things. In the case of schools, the specific school clauses are sufficient, but the "exposure" clause is very comprehensive, and might on occasion be very convenient in application.

5. *Summary of Powers for Dealing with Infection among School Children.*

(*a*) Under the Infectious Disease (Notification) Act, 1889, at least two of the diseases common among school children, namely, diphtheria (including membranous croup) and scarlet fever—must be notified to the medical officer of health of the district. Typhus fever, typhoid fever, smallpox, cholera, erysipelas, also fall to be notified; but they are relatively rare at school. The notification is normally made by the "medical practitioner attending on or called in to visit the patient"; but on occasion, the teacher as a "person in charge of or in attendance on a patient" might fall under obligation to notify.

(*b*) The medical officer of health has power to enter the school and examine the children in order to ascertain whether any one is suffering from infection.

(*c*) Infected children must be excluded from school.

(*d*) Children, not themselves infected, but coming from infected houses, must also be excluded from school.

(*e*) In the case of infected children, parents that fail to produce a certificate of freedom from disease and infection before sending their children again to school are liable in a penalty of 40s.

(*f*) Teachers that admit such children without certificates are also liable in the same penalty.

(*g*) Under the Public Health (Scotland) Act, 1897, sections 46, 47, and 48, the local authority has full powers for disinfection of infected schools and of all articles contained in them.

(*h*) Under section 56 of the same Act the local authority has power to control the exposure of infected children in public places.

(*i*) The Education Code provides for the closing of a school in compliance with a notice of the local authority.

The carrying out of these arrangements is the specific work of the local authorities for public health. As, however, it is the interest of school boards to eliminate from their schools all infectious children and all children exposed to infection, and as they are, by a special provision of the Education Code, protected against loss of grant, the aims of local authority and school managers are practically identical. Infection is always an interference with school efficiency; it is equally a danger to the public health. Consequently, both the educational authority as such and the public health authority as such are under obligation to deal with it.

6. *Control of General Sanitation of Schools.*

But the control of the local authority over the schools does not end here.

Since the term "house" includes "school," all the sections of the Public Health Act applicable to houses apply equally to schools. Further, the term "premises" under the Act includes "buildings." The general provision of

the nuisance section—section 16—may thus be applied to the supervision of schools. In particular, sub-section 7 specifies, "Any house or part of a house so overcrowded as to be injurious or dangerous to the health of the inmates." Overcrowding in this section would doubtless be interpreted in the light of the Education Code, which lays down a minimum cubic space and minimum floor area for schools.

By article 17 of the Scotch Education Code, 1903, "Before any grant is made to a school the Department must be satisfied that . . . the premises are healthy, well lighted, cleaned, warmed, drained, and ventilated, properly furnished, supplied with suitable offices, and contain sufficient accommodation for the children attending school." In a note it is added:—"In administering this article the Department will endeavour to secure at least 80 cubical feet of internal space, and 8 square feet of area, for each child; but in schools erected since the 1st January, 1874, with the aid of a building grant or loan, the average attendance should not exceed the number of children for whom the plans were approved by the Department. There should be exhibited in each class-room, or room in which instruction is habitually given, a placard showing the accommodation of the room calculated in accordance with the foregoing rules."

(*a*) *Control of Cleanliness and Ventilation.*—That in relation to premises so important as schools all doubt in the application of sections or sub-sections may be removed, the Act provides under section 16 (8) as follows:—"Any schoolhouse . . . not kept in a cleanly state and free from effluvia arising from any drain, privy, water-closet, earth-closet, urinal, or other nuisance, or is not ventilated in such a manner as to render harmless so far as practicable any gases, vapours, dust, or other impurities generating in the course of the work carried on therein, that are a nuisance or injurious or dangerous to health, or is so overcrowded while work is carried on as to be injurious or dangerous to the health of those therein employed." This sub-section applies both to school-

houses and to such factories as are not otherwise provided for. The last two-thirds of the sub-section cannot reasonably be applied to schools, since, without misuse of terms, the "work carried on therein" cannot be regarded as within the context of the sub-section. The first part, however, is perfectly explicit, and is sufficiently comprehensive for ordinary administrative purposes.

One of the cardinal conditions of adequate ventilation is adequate cubic space. The amount of cubic space, however, has to be determined by the use that is made of each particular building. For a common lodging-house, where the inmates occupy the rooms over-night, one standard of cubic space is enforced—usually three to four hundred cubic feet per head. For schools, which are occupied only during the day, and where no room is occupied for more than two hours continuously, another standard is applied, namely, eighty cubic feet per scholar. With so low a standard of cubic space it is extremely difficult to maintain physiological purity of air. As, however, this minimum cubic space is a result of practical necessities, systems of ventilation must be adapted to it. The local authority in approving plans takes this fact into account. By the Public Health Act no limit of cubic space is fixed for the determination of overcrowding, which, therefore, is in each case a matter for consideration on the merits. Within the limits of the Code, accordingly, the local authority has full control over the ventilation of schools.

(*b*) *Provision of Water-closets, &c.*—Further, by section 29 of the Public Health Act, "The local authority may also by written notice to the owner or occupier of any schoolhouse . . . require them or either of them within a time specified to construct a sufficient number of water-closets or privies for the separate use of each sex."

(*c*) *Other Sanitary Conveniences.*—These, if they are part of the drainage system, are on the same footing as

drainage. Where they consist of so-called dry closets, latrines, or earth-closets, they come under the disposal of refuse. In every case, both from the nuisance standpoint and from the standpoint of structure, the local authority has control.

(*d*) *Provision of Drainage.*—Under the general powers conferred by the Public Health (Scotland) Act, 1897, section 16, the local authority can deal exhaustively with drainage. So far as drainage results in nuisance it can be remedied by the procedures applicable to nuisances under section 16 (8). So far as construction is concerned, the local authority, besides having the powers under building bye-laws, has particular powers under the Public Health (Scotland) Act, section 120. According to this, "If a house . . . within the district of a local authority is without a drain or without such drain as is sufficient for effectual drainage, the local authority may, by notice, require the owner of such house . . . within a reasonable time therein specified to make a sufficient drain."

(*e*) *Provision of Water Supply.*—Under section 16, sub-section 3, "Any well or water-supply injurious or dangerous to health" is a nuisance. Under the same section, sub-section 2, any water-course "so foul or in such a state or so situated as to be injurious or dangerous to health" is a nuisance. By section 125, county local authorities have the power to enforce a supply of water, and there is an elaborate system of administration provided by the Act for carrying out all the necessary procedure. In burghs, the town councils are endowed either by the Burgh Police Act, 1892, or by special Acts, with full powers to enforce adequate water supplies in all premises. It may, therefore, be said that the local authority has full power over the water-supply of schools.

7. *Control of Buildings.*

But the control even of the general sanitation of schools

does not confine itself merely to administration or amendment of existing premises. In counties, the powers are much more comprehensive. In the towns, too, there is a control of the plans of buildings, but, except in the cities with special Acts, the powers are not so exhaustive as in the counties.

(a) *Control of Buildings in Counties.*—By section 181 of the Public Health (Scotland) Act, 1897, the local authorities of counties are empowered to make bye-laws for the regulation of buildings. These bye-laws, which must be approved by the Local Government Board, cover the whole structure of buildings.

Section 181.—(1) The local authority of any district other than a burgh may, subject to the approval of the County Council, make bye-laws for the whole or any part of their district for regulating the building or rebuilding of houses or buildings, or the use for human habitation of any building not previously so used, or any alteration in the mode of occupancy of any existing house in such a manner as will increase the number of separate houses in respect to the following matters:—

(*a*) The drainage of the subsoil of sites for and the prevention of dampness in houses intended for human habitation;

(*b*) The structure of walls, foundations, roofs, and chimneys of new buildings in so far as likely to affect human health;

(*c*) The ventilation of houses and buildings intended for human habitation;

(*d*) The sufficiency of the space about buildings to secure a free circulation of air;

(*e*) The construction and arrangement of the drainage of houses and buildings and of soil-pipes and waste-pipes, and the construction and position of water-closets, earth-closets, privies, ash-pits, cesspools, dungsteads, slop-sinks, and rain-water pipes and rhones;

(*f*) The production of suitable building plans in respect of matters in this section mentioned, and their inspection;

(*g*) The intimation previous to the commencement by the owner or person laying out the work to the local authority of the date of the commencement, and for

the due inspection in respect of the matters in this section mentioned of houses or buildings in process of erection or alteration, and the examination of the drains thereof, and for the pulling down, alteration, or amendment of any work which has been carried out in contravention of the bye-laws.

(2) In making such bye-laws, the local authority shall have regard to the special circumstances of their district, or the part thereof to which such bye-laws relate.

Section 182.—(1) It shall not be lawful to erect a new building on any ground which has been filled up with any matter impregnated with fæcal, animal, or vegetable matter, or upon which any such matter has been deposited, unless and until such matter shall have been properly removed by excavation or otherwise, or shall have been rendered or have become innocuous.

(2) Every person who does, or causes, or wilfully permits to be done, any act in contravention of this section, shall for every such offence be liable to a penalty not exceeding five pounds, and a daily penalty not exceeding forty shillings.

(b) *Control of Buildings in Towns.*—Under the Burgh Police (Scotland) Act, 1892, or under various special local Acts, all the town local authorities of Scotland have, in greater or less degree, similar control of all buildings within their district. In most instances, the town local authorities are supplemented by the "Dean of Guild Courts." In a few cases, plans and buildings are directly controlled by building committees. In all cases, the control of the plans and fabrics of schools is more or less complete. It has to be remembered that the local functions both of school boards and other authorities are always supplemented by the requirements of the Scotch Education Department. It is unnecessary here to detail further the range of the various jurisdictions over school buildings.

8. *Sanitary Control of English State Schools.*

So far the powers under the Scottish Public Health Law and Code of Education. It is instructive to compare the trend of opinion among medical officers of health and medical officers of schools in England, who have recently

suggested certain resolutions for the consideration of the Central Education Department of England. These resolutions embody certain directly practical propositions for increasing the sanitary control of schools. They were moved by Dr. Arthur Newsholme, whose long experience both as a medical officer of health and a medical officer of schools is sufficient guarantee both that the propositions he may advocate are themselves reasonable and that he has found them necessary in the routine of his duty.

The resolutions were preceded by a discussion. In the opening paper, Dr. Meredith Richards said—

"*Right of entry and examination of scholars* are essential to success in dealing with infectious disease, and should be granted at once, even if the other reforms have to be postponed. Dr. Crocker (now of Richmond) succeeded in 1901 in obtaining these powers for Eccles by a private Act, from which he has kindly furnished me with the following extracts:—

> "'Clause 132.—The medical officer may enter any public elementary school within the borough at all reasonable times and examine the scholars attending the same, and may exclude from attendance thereat for such period as he shall consider requisite any scholar who in his opinion is suffering from infectious disease or is likely to spread infection. . . . Any person who shall obstruct the medical officer, or any medical practitioner appointed as aforesaid, in carrying into effect the provisions of this section, or who shall permit any scholar to attend school after he shall have been excluded as aforesaid and before the expiration of the period of exclusion, shall be liable to a penalty not exceeding 40s.'
>
> "'Clause 130.—No person being parent or having care of a child who is or has been suffering from infectious disease shall, after a notice from the medical officer that the child is not to be sent to school, permit such child to attend school without having procured from the medical officer a

certificate (which shall be granted free of charge upon application) that in his opinion such child may attend without undue risk of communicating such disease to others.'

"There is everything to gain by extending these or similar provisions to the country generally."

"The resolutions as finally adopted were as follows:—

"'That the Parliamentary Committee be requested to make immediate representations to the Parliamentary heads of the Board of Education and Local Government Board that in the opinion of this society—

"'1. That the hygienic control of public elementary and of other public schools should devolve on the medical officer of health of the district.

"'2. That the medical officer of health, or a medical practitioner acting under him, should be given power of entry and power to examine scholars on the same lines as laid down in the Eccles Corporation Act.

"'3. That the standard of cubic space in all schools should be raised to the maximum at present existing.

"'4. That a standard of purity of air in schools would be of great assistance.

"'5. That schools claiming grants should be required to produce a detailed report from the medical officer of health as to their sanitary condition of a form to be approved, showing that they are in a sanitary condition.

"'6. That the medical officer of health should be required to record the action taken by his department in regard to schools, and to forward annually to the Board of Education such portions of his report as relate to this subject.

"'7. That the Board of Education should secure a skilled medical adviser to co-ordinate the sanitary regulation of schools, and to organise a code of preventive measures applicable to schools.

"'8. That school teachers should be instructed to notify to the medical officer of health the occurrence of cases of alleged or of suspected infectious disease, and to furnish such other information as may be reasonably re-

quired by the sanitary authority. That it should further be obligatory on school teachers to carry out the requirements of the medical officer of health as to the exclusion of suspected cases of infectious illness, subject to an appeal to the Board of Education.' "—(Public Health, vol. xv., p. 128.)

9. *Conclusion.*

These references indicate that the local authority for public health already has the power of control, first, over infectious children and children exposed to infection; second, over the sanitation of the school. So far, therefore, as the contemplated increase in the medical inspection of schools must concern itself with the infection of children and the sanitary control of premises, no new powers are necessary if such inspection is to be regulated by the local authority. Further, a system of individual health inspection merges ultimately, as the Commission's report shows, in questions of public health, for example, housing, ventilation, water supply, drainage, &c. A large part of such inspection, however, has direct reference to individual efficiency and no direct reference to public health administration. The local authorities, therefore, while they are, by their existing powers and duties, suggested as the controlling agencies in the medical inspection of school children, have not all the powers necessary for the complete health inspection here sketched.

But it is clear that already the whole principle of the medical inspection of schools and school children is embodied in the law of Scotland. It remains to consider what further extensions of the principle are necessary to realise in detail the recommendations of the Physical Training Commission. As it is reasonably certain that, within a short period, the education areas for the counties will be altered and the educational authorities reconstituted, no plan based upon the assumption that the present school boards or school board areas are permanent need be at present considered. The scheme we shall now suggest for the organisation of a medical inspection of

schools is based explicitly on the assumption that some reconstruction of the administrative bodies will be carried out and that the relation between the county school authorities will become much more intimate. The reorganisation thus involved is so essential to efficient inspection of schools that we shall consider it in a separate chapter. The necessity for such a scheme cannot be fully appreciated until the contents, the materials, of a medical inspection are illustrated in detail. The sections dealing with the various departments of inspection will bring out incidentally many points of contact between the functions of a public health authority and the functions of an education authority. It will be seen that the functions of the public health authority may reasonably be extended to include not only the health of children as affecting each other, but also their health as affecting their progress at school and their capacity when school is over. It would be extremely short-sighted policy to limit the view of public health merely to the prevention of infectious disease, when by the examination of ALL diseases, infectious and non-infectious, many defects in the healthiness of the environment would immediately stand revealed. It cannot be too clearly understood that the effect of the environment, both organic and inorganic, can be discovered best by the detailed examination of the child. And when we say environment, we mean everything that contributes to the nurture of the child. It is, therefore, no extension of principle and no great extension of practice to include among the duties of the public health authority not only the direct prevention of infectious diseases, but also the direct and indirect prevention of all preventable general diseases. That these latter constitute a very large quantity will be obvious from the details furnished out of the Edinburgh and Aberdeen reports. These show that our contention is not based on theoretical physiology, but on hard facts.

CHAPTER VI.

The Organisation of Medical Inspection.

1. *Suggestions by Royal Commission.*

Among the witnesses examined by the Royal Commission were several medical officers of health and others interested chiefly in the public health aspects of school life. This arose out of the fact that the only public organisations explicitly dealing with the health of school children and with the hygienic conditions of schools are the local authorities for public health. It naturally followed that the evidence of those witnesses tended in the direction of increasing the sanitary control of schools. The Commission were so impressed both with the amount of defect found among the children examined at their request and with the value of the existing organisations as a basis for developing a system of medical inspection, that their recommendations include a large number of purely public health suggestions. A summary of these suggestions is in place here.

2. *Defects in Medical Data.*

The Commission regard the defects in medical data now available as constituting " a very serious defect in our school organisation." They attribute the insufficiency of medical data to the want of a system of medical inspection. They consider that " such a system is urgently demanded mainly for remedial objects, but also in order to make available information of the highest value both for ascertaining the facts of national physique and the means that may be adapted for its improvement or for retarding such degeneration as may be in progress."—(Report, page 28.) They point out that " it is impossible to get beyond mere guesswork except by a steady and continuous collection of facts, and the only feasible way of getting at such facts

is by weighing and measuring and carefully estimating the conditions as to health or disease, and the development and growth or decay of school children. It is only at this age that a complete examination of the population can be obtained; and for the pupils themselves, as well as for the nation, as a whole, it is of vital importance, as is shown in Part V., page 21, of our report, that this opportunity should not be lost." (Sec. 151.)

3. *Other Objects of Medical Inspection.*

Among the other objects of medical inspection the Commission include the following:—

(*a*) Uniformity in the granting of medical certificates of illness, in the methods of detecting infectious disease, and the limitation of such diseases as affecting school arrangements.

(*b*) The detection of defects in sight, in hearing, in mental development, or such physical weakness or state of nutrition as may demand special treatment in connection with school work.

(*c*) The remedy or correction of defects by early attention, or inculcation of simple rules for the conservation of health, of physical strength and of physical faculties.

(*d*) Increased sanitary inspection of schools, particularly for the improvement of ventilation and heating.

(*e*) Increased inspection of latrines and offices, and maintenance of extra-mural cleanliness, and propriety.

4. *Organisation Available.*

With these objects, the Commission suggest that the existing organisations should be made more effectively available than they at present are, and that powers of obtaining medical service should be increased.

"We think, therefore, that school authorities should have better means of obtaining adequate medical assistance in connection with their work. (Sec. 157.)

"We suggest that the medical officers of burghs and counties should, where their services can be obtained, act as referees and consulting officers to whom the school boards within the area should be able to resort for advice

in regard to special difficulties; and that, where this is not the case, special officers should be appointed for the purpose. They should receive reports from local medical officers, and, if necessary, call the attention of the school authorities to any striking features in these reports. Their remuneration might take the form of a retaining fee proportionate to area and population, perhaps not exceeding £100 a year; and in our opinion it ought to be borne by Imperial funds. (Sec. 158.)

"Next, it should be the duty of the district medical officers to visit and report upon all schools in their district, being remunerated by a certain fee for each school proportioned to the number of scholars. They should certify as to the school being closed or re-opened on account of infectious illness; should decide on the questions that emerge in cases of infectious disease in particular children; should furnish the certificates required in the case of children withdrawn from school; and should prepare statistical reports upon the physical condition of the pupils of the schools. They should be in touch with the school authorities, and should be paid by these authorities, although we think that a certain grant in aid of such remuneration should be paid out of the Parliamentary Vote. They should also report on special points, as occasion may require, to the county medical officer. (Sec. 159.)

"Lastly, we think that great assistance might be given to the school authorities by the appointment, to serve under the Education Department, and as supplementary to the present inspecting staff, of a certain number of sub-inspectors, to make occasional visits to the schools for the purpose of examining their sanitary conditions, and the health and cleanliness of the scholars. The assistance of women might often be useful in this work, so far as it regards the girls and infants, and the effect of physical training in their case." (Sec. 160.)

5. *Remarks on Commission's Suggestions.*

Among the objects of medical inspection here suggested, it is obvious that matters of public health take a leading

place. No distinction is made in the organisation necessary for the supervision of schools from the public health standpoint and the supervision from the medical-examination standpoint. The absence of such a distinction and the recommendations contained in paragraphs 157 to 160 seem to imply that the Commission regarded the hygienic inspection of schools as necessarily merging into the more extended individual inspection of children. This view is entirely in accord with what we have formed on other grounds. It is, in practice, impossible to draw any clearly marked line at the point where the public health jurisdiction should end and the general medical inspection of children should begin. On the contrary, the considerations adduced by the Commission and those adduced in the previous chapter, combine to show that already the statutory duties of the public health authorities cover almost all that can properly be named medical inspection. Accordingly, any scheme based on the extension of public health duties will be in conformity with the proposals of the Commission.

6. *Medical Assistance Available.*

In paragraph 157, the Commission suggest that "school authorities should have better means of obtaining adequate medical assistance in connection with their work." In the paragraph immediately following, it is suggested that where possible the services of the medical officer of health should be available for reference and consultation. These two propositions do not necessarily depend on each other. The view may be taken that the larger school boards should appoint medical officers to do all the work that is not normally overtaken by the public health officers and that the smaller school boards—for example, those of the smaller towns and the less populous counties—might combine for the purpose of the same medical inspection.

Whatever may be said for such a scheme from the medical standpoint, there are possible objections to it from the administrative standpoint. In the great cities, it is true, the school boards are, as a rule, large enough to

justify the whole-time service of a medical officer of schools; the special medical work of a non-public health order may be so great as to demand much more medical service than any public health organisation could reasonably be expected to provide. In the case of the smaller school boards, the difficulty of obtaining skilled medical service for the detailed work indicated in the preceding chapters is greater. But the medical service available in the more outlying regions is, for the most part, already in official touch with the public health organisations. Already the local practitioners perform some of the services that are specified in the Commission's report as desirable. From the nature of school distribution, however, it would, in many instances, be impossible for a local practitioner to undertake more than a single school. If, therefore, the public health organisations of town or county are not adjusted to include the local practitioners so appointed for a school, the result will be the accumulation of local facts without any means of correlating them for the districts as a whole.

7. *Reorganisation of Administrative School Areas.*

If, however, as already suggested, the school boards and school board areas be reorganised, the case is wholly different. If the district committee, which combines the larger interest of the county with the local interest of the parish, should become the local authority for education as well as for public health, the most reasonable and the most natural development will be to constitute the chief medical officer of health of the district also chief medical officer for schools. Such local practitioners as may then be appointed would, as the Commission suggest, become responsible for reporting to the district medical officer. The system of medical inspection of schools would thus be definitely correlated with the system of public health executive. The difficulty of distinguishing between public health proper and medical examination proper would not disappear, but it would cease to be important. The medical officer of health for the district would act in two capacities.

As medical officer of health, he would be responsible for the public health administration; as chief medical officer for the district schools, he would occupy towards the medical officers of schools precisely the same relation as, in the other capacity, he occupies towards local public health medical assistants. Like the district committee itself, the medical officer of health would, as such, direct the public health administration of the school, and, as medical officer of schools, he would direct the general medical examination of the children. He would control at once the hygiene of the school and the health of the scholars.

8. *District Committee as Education Authority.*

It is here assumed that the district committee, if adopted as the basis for the new school authority, will be so modified in constitution that it can adapt its activities to the multifarious duties of school administration. On their present footing, the district committees are so rigidly limited in expenditure, so completely subject to the County Councils in finance, that they cannot in any sense be regarded as independent organisations. In the management of roads and bridges, this rigidity of mechanism is not felt as a disadvantage, because in these matters the whole county is equally concerned. In public health, financial methods sometimes give rise to difficulty. No district committee can incur any capital expenditure without the sanction of the County Council and the Standing Joint Committee. The Standing Joint Committee is the survival of a system of representation based on an entirely different franchise from the County Council or Parish Council franchise. This committee may always be trusted to act as a check on the extravagance of county or local authorities; it is sometimes apt to operate as an obstruction to them in the proper discharge of their duties, and it is difficult to find either in theory or in practice any thorough justification for retaining so anomalous a body. It is obvious that if the district committee is to be adapted to school purposes, it must have its relations to the Standing

Joint Committee modified. It must also be made capable of absorbing educational experts of all leading grades of education. It is not our business to consider whether the district committee forms the best basis for the new educational authority; we are merely concerned to show in what directions its functions should be elaborated.

9. *Public Health and Private Practitioners.*

Such an organisation implies that medical practitioners in private practice would become responsible for particular schools. In many cases, this arrangement would be entirely satisfactory. In many others, it would be more doubtful. A study of the schedule will show that an exhaustive examination of school children pre-supposes a considerable amount of special experience and a considerable outlay of time. In the growth of the public health service, it has been found that the drift of professional opinion has tended in the direction of separating the public health functions from private practice, except in so far as specific statutes lay equal duties upon all private practitioners as such. In public health administration there are special reasons to justify this opinion. It is found that occasionally the interest of the private practitioner and the interest of the public do not coincide. Medical officers of health, when also engaged in private practice, thus not infrequently are placed in embarrassing situations. As the public health service has grown in Scotland, this has become more obvious. Recently, the Secretary for Scotland, after a re-consideration of the whole case, issued a circular "prescribing the conditions under which the county council will in future be entitled to obtain a share of the £15,000 contributed under the Local Taxation (Customs and Excise) Act, 1890, towards the cost of medical officers and sanitary inspectors." The circular proceeds—"Lord Balfour has, as you are aware, always held the view, and, after the experience of the past seven years, is now fully convinced, that, in the best interests of sanitary administration, the county medical officers should not be allowed to engage in *general* private practice,

so that they may be enabled to devote their energies to the special and important public duties which they undertake to perform.

"His Lordship has accordingly determined to lay down, as a necessary condition of participation in the grant, that the county medical officers shall be expressly prohibited from engaging in general private practice. . . .

"The Secretary for Scotland does not, however, hold so strong an opinion in regard to medical officers being permitted to take *consulting* practice, as distinguished from *general* private practice, and he does not, therefore, propose to withhold the grant in the case of medical officers engaging in consulting practice with the statutory consent of the county council; but in such cases it must also be shown to the satisfaction of the Secretary for Scotland that the circumstances are exceptional and really justify this relaxation." (Scottish Office, Whitehall, 9th December, 1901.)

10. *School Inspection and Private Practitioners.*

In the appointment of private practitioners to be medical officers of schools, difficulties of the same nature as is here implied would be apt to arise. The interests involved, however, would not be of the same kind. Already, as we have seen, it is possible so to relate the private practitioner to the chief medical officer of the district as to make administrative friction impossible; but this arrangement would not prevent the possibility of friction between local practitioners. It rarely happens that all the children attending any school are patients of a single practitioner. Consequently, any examination made at school might be resented both by the parents and by their medical attendant. Many ways suggest themselves for preventing this entirely undesirable friction. In the less opulent counties, some definite adjustment will be necessary, since there is no obvious method of superseding the private practitioners. But in the larger counties, the more desirable line of development would be the appointment of whole-time assistants to the county medical officer of

health. In at least two counties in Scotland, the county medical officer of health has one or more whole-time assistants for public health work alone. This system obviates the necessity for resorting to practitioners in private practice, it prevents the interference of one practitioner with the practice of another, and it leaves in the absolute control of the county authorities the disposal of the assistant's time. If the medical inspection of schools is to be conducted in the thorough and detailed way contemplated by the Commission, the appointment of whole-time assistants, at least in the larger counties, will become an absolute obligation.

11. *Non-Medical Assistants.*

It is, however, as indicated in paragraph 160 of the Commission's report, not necessary that all such assistants should be graduates in medicine. It is true that a large part of the work of medical inspection can be carried through only by a medical practitioner; but certain subsidiary inspections may be efficiently done by non-medical assistants. At some point in the inspection, however, the medical practitioner must be present. The final examination of eyes, ears, teeth, nose and throat, glands, heart, lungs, and all named diseases, can be properly done only by one trained in medicine. We have already shown how much the teacher can do to assist medical inspection of children. The Commission, doubtless, contemplated that non-medical assistants should be available for the inspection of school premises. But these are already provided for under the Public Health Act and the Education Code. The remaining point of importance is to what extent non-medical assistants can undertake the detailed work of the medical inspection schedule.

12. *Organisation in Burghs.*

It has further to be remembered that all the burghs of Scotland are independent local authorities for public health. In many of them, however, the medical officer of health is a medical practitioner in private practice. In

many others, the medical officer of health for the burgh is also county and district medical officer of health. As it has been found advisable to combine the smaller burghs with the counties for public health administration, so it will be found in the case of educational administration. On the supposition that the small burghs will be definitely subsumed in the new education authority, no difficulty need arise in organising a medical inspection of schools. But if the district medical officer is to have entry into the burgh schools for the purposes of medical inspection of scholars, but not for the purposes of public health executive —this remaining with the burgh medical officer of health— a new cause of friction between burgh and county will at once emerge. Doubtless, this will be avoided where the medical officer of health for the county is also medical officer of health for the burgh; but unless this be so, friction between the two public health organisations is inevitable; for we have seen that no precise line can be drawn between the public health aspect and the purely medical aspect of the school child. If any system of medical inspection is to be successively inaugurated, it must avoid these administrative pitfalls. If it does not, the result will be dissatisfaction with the work done, perpetual complaints from one authority to another, and a tendency to let action drop between two responsibilities.

Paragraph 158 of the Report expressly suggests that the medical officers of burghs and counties should act as referees and consulting officers to school boards, and that where this is impossible, officers should be appointed for the purpose.

13. *District School Boards—Dr. Douglas' Scheme.*

In their small book on Scotch Education Reform, Dr. Charles Douglas, M.P., and Professor Henry Jones propose as the elements of a reformed educational system, first, a system of district school boards as the local authorities and a national council as a part of the central authority for education. The area chosen for the district school boards is the same as the area of a county district. We are not

here concerned to discuss the merits of the scheme; but we may point out that so far as medical inspection is concerned, such district school boards would be in much the same relation to the present district committees as the present school boards are. Whether the school board be the parochial unit or a district unit, it will be the owner of the schools, it will be responsible for their sanitation, and it will come under all the same obligations as a school board at present does. If such a district board should decide to ascertain the health conditions of the children entrusted to it, it would of necessity follow the same methods as are at present available. That is to say, on the one hand, it would benefit by the routine inspection of the district medical officer of health, and, on the other, it would economise by employing him to direct such detailed examination of children as would not normally fall to him under the Public Health Act. What we are anxious to make clear is that the present powers of the local authority for public health are such as cannot be abrogated in favour of any new organisation; that any organisation hitherto proposed would in no way benefit by taking over such powers, and that the public health relations of schools to the remaining community are of so intimate a nature that they perpetually demand the care of the public health authority.

It is, however, immaterial how the enlarged school area shall be managed; the functions of the local authority for public health will always be paramount. We have already shown that all sanitation and all infectious disease normally fall to the executive of the local authority; that a great number of non-infectious diseases are equally an index of the sanitary condition of the community, and that the remaining diseases are in amount so trifling that the inspection of them may well be added to the duties of the public health authority. Our argument is unaffected by any variation in the particular schemes for reforming the school areas. The essential point is that as a local authority primarily concerns itself with the preventable diseases, so the educational authority shall primarily con-

cern itself with the defects that obstruct the child's education. If the district committee, with such modifications as expediency may suggest, should be made the education authority, or district school board, then there can be no conflict of duties. If, on the contrary, the new district school board should be a different body from the district committee, it ought to be very easy to arrange a system of medical inspection, of which the local authority for public health should have the main direction. The district school board might provide the local assistance necessary for the medical officer of health, or at least contribute a share to the expense. In any case, it should be clearly understood that the medical inspection for public health purposes and the medical inspection for educational purposes should be perfectly continuous, that no effort should be made to divide the child, as it were, into two, the one part to be examined medically for public health purposes, the other for purposes of education. From such duplication of functions nothing but confusion can result. There should be no difficulty whatever in satisfying both the objects of the district committee and the objects of the district school board. The schools and the school children will be a common meeting ground, and the system of medical inspection will unify the interests of both authorities.

14. *Co-operation of Town and County Districts.*

Whatever be the scheme adopted—district committee as school board, or, as suggested by Dr. Douglas, district school boards—there will be some difficulty in adjusting the general medical examination of children to the public health examination of schools and children. If the burghs were included in the district for all purposes, public health and education alike, no conflict of duties would be likely to arise. As it is, however, the town council is the local authority for public health. It is thus responsible for all the sanitary and medical inspection already described as part of the duty of the public health authority. But the burgh school serves not for the burgh alone, but for the surrounding district as well. It would, therefore, normally

pass under the jurisdiction of the educational authority for the district. The educational authority will doubtless provide, in such cases, for the proper representation of the burgh; but such representation cannot interfere with the public health representation on the district committee. Accordingly, a certain amount of dual control is likely to remain whatever be the scheme adopted. As, however, it is equally the interest of the public health authorities (district and burgh) and the educational authority to have the school exhaustively inspected, a clear case for co-operation between educational authority and public health authority is established. The medical officer of health of the district and the medical officer of health of the burgh, where the two officers happen to be distinct, will co-operate in the examination of the school children. If the new school district authority should, as is likely, find it necessary to appoint a special assistant or assistants for part of the inspection of schools, the burgh will also share in the services of assistants so appointed. The work to be done will become easicr the more it is sub-divided. At the same time, the medical inspector whose experience is widest will attain to greater speed in the examination of children, and accordingly it will be to the interest of the various authorities to unite in a single organisation for the medical examination of children.

In this connection we are less concerned with the finance than with the feasibility of the organisation; but the finance should present no more difficulty for the burgh than for the district. Where any difficulty does present itself, the interests of the burgh will lie in the direction of co-operation with the district. Co-operation secures greater diffusion of expense.

15. *Suggestions by Dr. Bruce.*

In a paper read before the Scottish branch of the Incorporated Society of Medical Officers of Health in November, 1902, Dr. Bruce, county medical officer for Ross and Cromarty, offered some "suggestions for a system of administrative hygiene in Scottish schools." He based

his suggestions mainly on public health grounds. As coming from a medical officer of a large but thinly populated county, Dr. Bruce's observations are an index of what is practicable. In addition to the public health duties already fully detailed there are the following:—

"Medical advice should be available where serious disease appeared to be present in the case of any pupil attending school, and also where the more ordinary infectious disorders, such as vermin, ringworm, &c., have to be dealt with. Such advice should also be at hand if there arose any doubt as to a scholar's suffering from serious defects of sight or hearing or from malformation or disease of the limbs or joints.

"And in this connection, and to guard against the possible evils of over-stimulation or oppression in the case of physical exercises, I am clearly of opinion that at least once in the course of every year, all the children attending school should be measured, weighed, and roughly tested as to their powers of seeing and hearing, and also as regards the condition of their limbs. This could be done at certain hours after school work or on Saturdays, by the teachers, who should, of course, be properly remunerated for their extra work.

"If this work were carried out by means of tables drawn up for the purpose, and under the general superintendence of the local medical officer of health we should secure by and by a collection of interesting anthropometrical facts. These would, if carefully and continuously set down, eventually help to solve that most interesting of all problems, the progress of the race, on the one hand, or its degeneracy on the other."

For the special carrying out of medical inspection Dr. Bruce suggests the following:—

"Assuming that some form of medical and sanitary inspection of schools is absolutely required, let us inquire how far it is necessary to go in this direction and in what manner any scheme for this purpose can be best adapted to the present organisations for education in our boys' and girls' public schools, primary and secondary.

"(1) There has to be a head or local director and it does not need, we think, to be argued at length, that this post should naturally fall to the chief medical officer of the county or burgh.

"He is already the servant of the local authority, which has to deal with the funds which so far assist in maintaining secondary and technical education. He is also within the specified area the authoritative exponent and administrator of sanitary work, which includes attention to schoolrooms and the general sanitary condition of their adjuncts.

"But he would require local and other help, both medical and sanitary, in order to cope successfully with this further work which it is supposed to allot to him.

"There would have to be a subordinate staff of available medical men, and there should also be some arrangement to meet the more limited and purely sanitary demands, not only of schools, but of scholars as well.

"(2) The work of the subordinate medical staff would be—

"(*a*) Granting certificates of non-attendance, when required by the school board, in cases of illness, whether infectious or simply such as would incapacitate the pupil from attending school.

"(*b*) Certificates for closing and opening of schools in the presence of epidemics, or for securing the isolation of children from special school districts.

"(*c*) Strict individual medical examination year by year (with the assistance of the school staff) of every pupil with the view of testing his or her physical condition and capabilities as to muscular power, capacity for seeing and hearing, and his or her body and cerebral development.

"The evidence given before the Commission has, we consider, established the great need for such particular examinations in the interests of the scholars individually. Such examinations will be more decidedly needed if physical training is now a compulsory portion of school work. But the information elicited will be of the most valuable kind from the point of view of its anthropo-

metrical results. In the whole range of political economy, no question is more important than whether the race is degenerating or improving in physique and bodily health. It is impossible to get beyond mere guessing or baseless opinions, except by a steady, continuous collection of facts. A little consideration will conclusively show that the one feasible way of getting at such facts is by the weighing and measuring and carefully estimating the genuine growth or decay of school children, this being the only age at which the complete examination of the great bulk of the population can possibly be obtained.

"(3) As regards ordinary sanitary arrangements, such as cleanliness of the schoolrooms and the clothes of the scholars; proper airing and heating of the classrooms; sweetness of the latrines and general tidiness of the school and its appurtenances, we believe that such matters would be best dealt with by a staff of female inspectors. But as long as school boards are individually independent, collective and continuous inspection will have to be left to the department. It may be well, however, to make a beginning by appointing only six such inspectors for all Scotland in the hope, if successful, that each county and burgh will in the future itself provide such an inspector or inspectors."

Such are the proposals submitted.

Now as to the cost of the proposed scheme.

(1) Under head (*a*) it is suggested that the medical officer of health should receive an addition to his salary of a sum not exceeding £100 per annum. Burghs of less than 10,000 of a population should fall into the county areas. On this basis the cost of this portion of the scheme would not amount in all to over £3500.

Under head (*b*), taking the number of scholars at 800,000, the total cost at 6d. per head per pupil, which we consider a fair but not high rate of remuneration, would amount to £20,000 a year, for the individual inspection of the pupils.

To this would have to be added the cost of sick certificates. These would not, we think, possibly exceed five

per cent. of the whole number of pupils. If each such certificate were paid for at the rate of 1s., the total cost would not exceed £2000. The closing certificate would only be required, we calculate, at an average rate of one per school a year all round. With 3000 schools, putting the cost of each of these at 5s., which is a reasonable charge, the total cost for 3000 schools would amount to £750 per annum.

Six lady inspectors, with expenses of travelling, &c., we may put down at £450 on each, making for six inspectors £2700 a year.

The total annual expenditure for medical inspection of Scottish schools would thus be—

Chief medical officers of health, - -	£3,500
Local medical inspectors, - - -	20,000
Non-attendance certificate, - - -	2,000
Closing certificate, - - - - -	750
Lady sanitary inspectors and expenses, -	2,700
Making altogether a grand total of -	£28,950

per annum, or less than £1000 on an average for each county in Scotland and not exceeding £10 per school.

16. *Critical Observations.*

It will be seen that the general outline of Dr. Bruce's scheme conforms to the conditions we have already expounded. We note, however, that there is a tendency to intermix duties that are clearly and specifically already provided for and duties that must accrue when the detailed medical inspection of schools is established. As from several standpoints we have already shown, the public health organisations must be paramount; but the duties already enjoined on the public health authorities are very extensive, and the mere fact that they have been only in part carried out in the detailed way ultimately contemplated by the statutes is no reason for regarding them as the specific work of the new educational authorities.

Further, our experience in the examination of 600 children does not justify us in assuming that the detailed work of medical inspection will constitute so small an addition to public health duties as Dr. Bruce's scheme seems to imply. Medical inspection is worth instituting only if it is to be thoroughly applied. The medical inspection of the schools, and, so far as infection is concerned, also of the scholars, is already, in the law of Scotland, abundantly provided for. All that is needed is the systematic application of statutory powers. But if the case we have already presented has any cogency, the medical inspection of individual children deserves to rank even higher than the medical inspection of the schools. Accordingly, such difficulties as exist cannot be met by minimising either the amount or the quality of the work to be done.

17. *Conclusion.*

The argument for organisation may be summed up in the following propositions:—

The public health authority should remain paramount; it should have the main direction of a medical inspection of school children; it should be the common ground for a union of county and burghal educational authorities. If the school board areas are to be extended, the same propositions will hold good. If school and public health authorities are to become identical, all difficulty of organisation disappears. If they remain separate, they must still readjust themselves primarily from the public health standpoint.

The proposed medical inspection of school children is, therefore, best regarded as an extension of the present public health inspection of schools.

PART II.

THE PRACTICE OF MEDICAL INSPECTION.

CHAPTER I.

General Sociology of the School Child.

1. *Immediate Object of Medical Inspection.*

The immediate object of medical inspection is to ascertain the fitness or unfitness of the school child for school life. And school life is determined by the system of education enforced. Some children—the majority—will be found fit; others—the minority—will be found unfit. It is the business of a practical medical inspection, first, to discover precisely in what way the unfitness is manifested, and second, to indicate how the conditions of school life shall best be adapted to the degree of unfitness. On the larger view, no doubt, medical inspection is only one mode of preparing the way for "the segregation of the unfit"; but on the shorter view, which is the only possible view for immediate practice, the medical inspector must satisfy himself with ascertaining the school efficiency of the school child.

2. *Relation to General Social Investigation.*

But to do even this effectively, he must consider the school child not as an isolated individual, but as a social product. School efficiency is, in mathematical language, a function of many variables. The school child in any given community is not an abstraction; he is a concrete organism. He possesses certain definite characters, of which some are inherited from his parents and others acquired through his own experience in the years before school life begins. In the most general terms, he is, in each individual instance, a resultant of two forces—Nature and Nurture. (This is one of Dr. Francis Galton's

favourite couples.) In any given community, individuals and groups of individuals, inheriting special characters of race, are modified by environment. This, for the purposes of school inspection, means principally the hygienic environment—soil, climate, housing, occupations, industries, economic conditions generally. All these, the school child in some measure reflects both in his inherited and in his acquired characters. Consequently, if he is to be studied with profit, if his physical and mental capacities are to be guided to the finest issues, if his diseases are to be readily discovered, tabulated, and prevented, he must be studied in all his fulness as a complex product of a complex social state. To do this exhaustively, however, demands the full resources of practical sociology. That would involve a detailed inquiry into each leading factor of the environment both inorganic and organic. It would necessitate, in particular, a minute investigation of housing, of the economic or wage-earning capacity of the parents, of the prosperity or the depression of local industries, of the healthiness or unhealthiness of local occupations, of the conditions determining the food supply, of the actual feeding of infants, of the nurture of the mothers during pregnancy, of the intermixture of races, of the degree of in-breeding of families, and of many other conditions, customs, and histories.

3. *Facts Available.*

It is obvious that, in large communities, such an extensive investigation demands the service of many departments. But even in the large communities, the organisations already at work are perpetually furnishing some guiding data for inductions of practical value. This is true especially of the public health organisations. They continue from year to year to furnish masses of facts, descriptions, exact figures as to births, deaths, diseases, occupations, &c., not less in the large than in the small communities. But in the small communities, it is occasionally possible to trace each child, as it were, to its "source." Every main fact of his physical and mental

environment can be ascertained. For instance, in the fishing villages of the Scottish coasts, it is within the range of practice to ascertain the whole history of a given child —the occupations of his parents, their wage-earning capacity, their nearness of kin, the amount of food they consume, the amount of food available for the child, the hours of sleep, the hours of labour, the hours of leisure, the precise conditions of industry, the hygienic conditions of the village, of the house, of the sleeping-room, the conditions of the soil, of the climate, of the water-supply, and, in general, the condition of all the leading forces that generate the child's mental and physical experience.

4. *Importance of Concrete Studies.*

It is not to be supposed, however, that these minute studies of the concrete organism can be followed up except in very favourable circumstances. They are referred to here merely to indicate that the medical inspection of school children is related at every hand to other methods of social investigation. It is, however, always possible for the medical inspector of any school to accumulate data that shall be capable of classification in the larger social investigations. For this reason it is important, as we have shown already, that he should record the general social conditions, the death-rates, the birth-rates, the prevailing diseases, the occupations, the industries, and, generally, the physical and economic condition of the given community. Without these details, it is difficult to place a value on the facts ascertained from the examination of individual children. If these facts cannot be related to the general truths already established regarding a given community, they are always open to criticism as being merely exceptional and sporadic. As we have shown at an earlier stage, the comparison of one city with another is of little value unless the primary social features of each are precisely ascertained.

5. *Factors of pre-School Life.*

In a series of short chapters, we propose to indicate

some of the leading influences that affect the fitness of the school child for his school life. As, however, it is the function of medical inspection rather to collect data than to make inductions, we shall endeavour less to prove our positions than to illustrate their importance. The school child, as he appears at school, has already lived through a long and adventurous history. He is born of parents of a given race, of a given community, themselves featured and developed by incalculable complexities of influence. He has inherited certain pre-dispositions of his parents. He may have been affected by the parental diseases. He may have suffered in his life before birth. He has, through many critical moments, struggled into individual existence. He has survived all the serious vicissitudes of his first week, his first month, his first year, his first five years. He has learned to walk, to talk, to assert his place in the mimic community of children. He has acquired individual habits. He has laid the basis of morals. He has come to some sense of individuality in the family. He has even acquired the rudiments of citizenship. He has at last made the great transition from the home to the school, from his cradle community to the community of strangers, from the soft nurture of family sentiment to the realities of discipline. At every stage in his history, he has acquired something that his whole life will not extirpate. He has been touched with some diseases that make him safe against them for ever. He has found his organs fit enough to carry him thus far. He is now about to enter a much vaster struggle, a more remorseless ordeal, a life full of greater stresses, energies, and dangers.

Is it not, therefore, important to search out some of the influences that govern the pre-school life? These influences it would be impossible to enumerate exhaustively. We propose to notice only the following:—The Racial Inheritance of the School Child, his ante-Natal Nurture, the Effects of Soil and Climate, the Effects of Housing, the Effects of Occupation, the Effects of Food. It is impossible to keep distinct the pre-school

effects of these factors from their effects during school life, nor is it necessary to do so. Our object is to emphasise the importance of these factors in the modification of the school child. They culminate in the production of an individual of a definite height, of a definite weight, and of a determinable stage in growth. In the section on growth, it will be shown how all these factors are concentrated. In this way, we shall hope to make clear the importance of noting peculiarities that are not in any specific sense medical, and yet are of primary and indispensable value in a medical inspection. If, by medical inspection of school children, we are to help the improvement and education of our national races, we shall do well to keep steadily before us these social factors in the life of the school child. So shall we be better able to assign values to our medical observations and to advise with greater intelligence on the possible and practicable remedies

CHAPTER II.

The Racial Inheritance.

1. *Race and Disease.*

That race counts for something both in general character and in the special diseases of children is certain. But in Western Europe, the races have become so mixed that in many instances distinctions can be drawn only when the most delicate anthropometrical tests are applied. At the same time, few of the communities fail to present certain definite racial strains that are easily distinguishable and easily recorded. How far this intermixture of races and the predominance of certain strains may affect the endurance or the susceptibility of the individual it would be hazardous to say; but that they have some effect is beyond question. And certain obvious explanations may be suggested. Race is after all only a name for the survival of certain selected varieties. Races differ from sub-races only in the greater remoteness of their common ancestry. In the long struggle, some, like the Jews, have emerged with certain peculiarities that are always pre-potent when this race intermixes with less individuated races. Some races are more liable to certain infections than others. Some are more liable to certain general diseases than others. Some, through long isolation, escape the infections familiar in Western Europe only to succumb as soon as they encounter them. The European goes into the malarious countries and finds death where the native lives, indifferent to the same dangers. The African native comes to Europe and dies in the climate that is the breath of life to the European.

These are mere truisms of the text-books. The distinctions between the great races are palpable and

unmistakable. But there is still much to learn of the minor effects of race on the health of a community. Light on these minor effects we may reasonably hope to obtain from the concrete study of school children through their school history. At the present moment, the data are vague and insufficient for any sure generalisation. It is, therefore, all the more urgent that the precise facts as to height, weight, rate of growth, susceptibility to infection, to special diseases, &c., should be recorded for the leading racial strains.

In the Edinburgh and Aberdeen investigations, the question of race was not specifically investigated; but incidentally some minor facts emerged. There was, however, nothing to indicate that the racial factor in the modification of the school child predominated over the primary biological conditions of food and housing. Doubtless, had it been possible to investigate minutely the differences among the Scandinavian, the Celtic, and the Jewish types, to name but these, the racial factor would have been found producing some subtle, pervasive results. To those that have had different races under medical care, there is no doubt whatever as to the differences in resistance between one race and another. Whether this be due to the food history of the particular race, or to the different diseases eliminated in the course of racial development, it is often difficult to determine. But the experienced physician can characterise without difficulty the history of a given illness as it affects a Lowland Scot, an Orcadian, a Shetlander, a Faroe Islander, a West Coast Celt, an Irish Celt, or a Jew. And the differences must be regarded as racial differences. Accordingly, the racial characteristics of the school child are not to be set aside as trifling or unimportant. They deserve to be carefully recorded wherever time and opportunity serve. Every fact that shall enable us the better to determine the part that the race-factor plays in the individual life enables us also to give more precise value to the factors of food and housing.

2. *Illustration.*

In illustration, we quote from the Royal Commission's report:—

"We cannot doubt that the quality of the houses where the children live corresponds, among other adverse factors, with the quality of the food they receive, and assent to the justice of Dr. Mackenzie's comment on the difference between the Bruntsfield and North Canongate Schools (the best and worst of those examined in Edinburgh), where he remarks that 'among the factors that produce' this great deterioration among the children in the North Canongate School, 'housing and food must be regarded as the chief. Race can scarcely count for much.' The verdict is equally true of the difference between Aberdeen and Edinburgh. Race fails to have any apparent bearing on the matter, judged by the cephalic index, one of the most abiding signs of race. Edinburgh, with an index almost uniformly just over 78, should show, were race the chief cause, a less striking contrast between its schools than Aberdeen, where there is more uniformity of conditions among the children of the different schools, though the co-existence of unfused races is greater, as shown by the cephalic index, varying between 81·4 and 78·5."—(Rep. of R. C. Ph. Tr., p. 24.)

3. *Influence of Race on Growth of the Individual.*

The question of growth will be more fully dealt with in the chapter on Height and Weight. But certain facts on the relation of growth to race may be given appropriately here. We quote from the article "Croissance," in Richet's "Dictionnaire de Physiologie." This article is characterised throughout by well-grounded judgments. It correlates with discrimination all the leading facts hitherto ascertained on the difficult problem of growth and its factors:—

"INFLUENCE OF RACE AND HEREDITY.

"It is difficult to separate these two factors, race and heredity.

May not certain peculiarities of heredity be said to constitute race?

"The existence of great races and small races is well ascertained in human species. The following table recalls certain facts in this connection:—

Stature according to race.

Tall statures (1·70 metre and over).	
Patagonians, 1·85.	Comanches, 1·8.
Polynesians, 1·76.	Iroquois, 1·73.
Scandinavians, 1·71.	Zulu, 1·70.
Scotch, 1·71.	Esquimaux, 1·70.
Above the average (1·65 metre to 1·69).	
Nubians, 1·69.	Germans, 1·69.
English, 1·69.	Arabs, 1·68.
Belgian, 1·68.	French, 1·65.
Below the average (1·60 metre to 1·64).	
Australians, 1·64.	Esthonians, 1·64.
Chinese, 1·64.	Bavarians, 1·64.
Jews, 1·63.	Japanese, 1·60.
Small (less than 1·60 metre).	
Malays, 1·59.	Ostiaks, 1·56.
Annamites, 1·59.	Laps, 1·53.
Siamese, 1·52.	Boshimans, 1·54.

'The tables given above make it appear that in Europe, for example, the Italians and the Belgians are smaller than the English or Germans. In the United States, children of purely American parents (this purity is entirely conventional) are a little taller than the children of German parents. On the other hand, Peckham finds that race has no influence on the weight, and Landberger does not find any evidence of its influence, up to the age of ten, at least, on the comparative proportions of Germans or Poles.

"Bowditch, who proclaims the superiority in weight and in stature of the 'pure' American children, takes full account, however, of the fact that the question is not so simple as one might at first believe. In fact, the majority of recent emigrants whose progeny is compared with that of older Americans belong to the poor and ill-nourished classes. Hence, differences are not

due to race alone. One can draw serious conclusions only by comparing subjects that shall differ only in race—subjects having physiological antecedents equally favourable.

"Broca used to say—'I have found that the stature of the French, considered in a general way, did not depend on altitude or latitude, or poverty, or riches, or on the nature of the soil, or of the food, or on any of the conditions of environment that may have been invoked. After all these successive eliminations, I have been led to think only of one general influence, namely, racial heredity.'"

["Note in passing, that in every country, whatever it be, there are racial varieties more or less numerous, and that the dominating and prosperous classes are frequently of one race, the lower classes of another; there is the conquering class and the class conquered, without counting the others."]

CHAPTER III.

Ante-Natal Nurture.

1. *Introductory.*

It is too much the custom to concentrate attention on the growth of the child after birth. It is time that some administrative notice were now taken of the child's history before birth. That the condition of the pregnant mother is of primary concern in the nutrition of the child is too obvious to need argument. But in what precise way the nutrition of the mother affects the nutrition of the child, is a subtle and profoundly difficult physiological problem. In any case, the ante-natal history of the child has hitherto remained a strictly medical question. There is something to say in favour of its continuing to remain so. Yet, if it can be shown that a good start in life depends primarily on the care of the mother during pregnancy, the question will necessarily become more and more important for the State, and it cannot be lightly set aside. Already a great deal has been done to investigate the effects of factory work on the health of mothers and the conditions of children. We shall indicate some of the definite observations recorded. Meanwhile, it has to be said that vast masses of the community are absolutely indifferent to the ante-natal care of offspring. The prospective mother has to proceed with her house-keeping as if she were in the normal condition. What should we think of a breeder of animals if he worked his brood-mares as hard during pregnancy as during the non-pregnant condition? What should we think of him if, besides over-working, he also under-fed them? Still more, what should we think of him if, instead of regarding

the production of young as a great expenditure of strength and as needing the conservation of all the reserves of animal energy, he regarded it only as an incident hardly needing to be noted? Will not any breeder of sheep tell you that if you want your lambs to die you have only to starve your ewes? Is it not a commonplace that the good nurture of the mother is an essential condition of good progeny?

What is true of the higher animals is true also of man. It would be insulting to the intelligence of this century to insist so much on the point were it not that the intelligence of the century has either not grasped the truth or is, from one circumstance or another, unable to act upon it. Perhaps there is something in both points. Partly, the common intelligence does not enter except shame-facedly into the biology of birth and the care that should precede birth. Partly, conditions of work and housing and wages make it impossible for the prospective mother to fulfil the conditions of nurture that experience shows to be necessary to the health of the infant. But whatever be the reason, children die by the hundred before birth, by the thousand after birth, because the mother has been over-worked or under-fed, or injured, or badly housed, or in one or several of many other ways rendered unfit to bear fully-grown or healthy children. How the conditions resulting from ignorance, or incapacity, or indifference, or economic conditions, are to be remedied, is too large a question to be answered here. But that the ante-natal mal-nutrition of children is a large factor in the life, and *a fortiori* in the school life, of the child hardly admits of doubt. The first step towards the discovery of remedies is the precise proof of the facts.

2. *Ante-Natal Nutrition as affecting Physique.*

That the physique of the child is largely determined by its ante-natal nutrition is extremely probable. It is maintained by experienced physicians that the length and weight of a child at birth depend on the feeding of the mother during pregnancy. On general physiological

grounds, we should expect no less. But if it be the case that the weight at birth, the completeness of development, the freedom from incipient diseases of mal-nutrition, the consequent capacity to resist the early infantile diseases, all depend in greater or less degree—but always in some degree—on the health and nutrition of the mother, it follows that the first condition in the promotion of good physique is the scientific care and nurture of the possible and prospective mothers. The condition of the infant at birth is not without consequence to his after-history. And the condition at birth is largely determined by the treatment before birth. The consideration of this question is of primary importance in estimating the effect of feeding, housing, occupation, physical exercise, physical discipline. It is now a commonplace of the recruiting authorities that three out of five recruits fall out as inefficient at the end of two years' training. The explanation offered by Colonel Maurice is that owing to bad nurture in the earlier days of life the recruits are incapable of developing in response to the improved feeding and developmental exercises of the army. May it not also be that a large percentage of them, having started badly even before birth, continue to reap the evil results of the bad start? No theory of physical training can be adequate that does not consider the whole history of the organism from conception to adult life. The Commission on Physical Training had before them a much more limited problem than this; but a careful study of their report leaves on the reader an impression that their conclusions would have been more adequately grounded had the question of ante-natal nurture been seriously brought to the test of evidence. If the infant after birth is so vulnerable to the influences of the ordinary environment that he survives his first year only with difficulty, much more will he be likely to suffer in the still more tender stages of his earlier history.

Dr. Chalmers, medical officer of health, Glasgow, has pointed out that among the children of Glasgow the peculiar distribution of deaths in the various quarters of

the first year of life indicates that the problem of infantile mortality can no longer be regarded merely as a question of food. He holds that it must be regarded as largely accounted for by the fatal results of injuries sustained before birth. If the infantile mortality be represented by a curve, it is found that the curve of mortality is highest in the earliest quarter, the period when we should expect the remote effects of ante-natal injuries or malnutrition.

"The almost complete failure of modern sanitation to influence to any considerable extent the rate of infantile mortality has frequently attracted attention, and has been the subject of much discussion.

"More than one-third of the total deaths of infants occur in the first month of life, when the principal causes of death are scarcely disease in the ordinary sense, but defects in development. Premature birth, atrophy, congenital malformations, and convulsions are prolific causes of death in these early weeks, and many of the causes then operative are related to defective conditions which are ante-natal in their origin, and are probably closely related to the nourishment of the mother during the period of gestation.

"After the first week the mortality rapidly declines, so that of the 3168 deaths under one year which occurred in Glasgow in 1902, 1100 took place in the first month, 327 in the second month, and 230 in the third month—more than one-half of the total infant deaths thus taking place within three months after birth.

"How much of this excessive mortality during the first three months of life is due to preventable conditions, external to the child and operative only after birth, and how far it is the result of maternal conditions which are operative to probably a larger extent in the production of still-births and other forms of intra-uterine mortality, still awaits solution.

"I have elsewhere pointed out that about 30 per cent. of our infantile death-rate occurs among the 14 per cent. of our population who occupy one-apartment houses.

"The following table gives the deaths from all causes occurring in each month of the first year of life in the year 1902:—

"NUMBER OF DEATHS OF INFANTS FROM ALL CAUSES IN EACH MONTH.

Under 1 month, - - - -	1100
,, 2 months, - - - -	327
,, 3 ,, - - - -	230
,, 4 ,, - - - -	205
,, 5 ,, - - - -	177
,, 6 ,, - - - -	171
,, 7 ,, - - - -	137
,, 8 ,, - - - -	208
,, 9 ,, - - - -	176
,, 10 ,, - - - -	155
,, 11 ,, - - - -	145
,, 12 ,, - - - -	137
Total under 1 year, -	3168

"Compared with several large towns, the infantile mortality in the 10 years, 1892-1901, and in 1902, has been as follows:—

	1892-1901.	1902.
Glasgow, - - - -	149	128
Edinburgh, - - - -	143	123
Dundee, - - - -	177	143
Aberdeen, - - - -	146	137
London, - - - -	159	141
Liverpool, - - - -	191	163
Manchester, - - - -	191	152
Birmingham, - - - -	189	157

"Among Scotch towns the infantile death-rate in Glasgow was exceeded in both Aberdeen and Dundee, while in the English towns referred to it is uniformly higher than in Glasgow."—(Report by M.O.H., Glasgow, for year 1902, p. 25-26.)

It is not possible to pursue the question further here; but it is raised in order to indicate that the life of the school child may in very definite ways be affected by his ante-natal history. It is, therefore, important that the

medical inspector should endeavour, wherever possible, to ascertain from all available sources definite information on the social habits of the mothers. Feeding, training, and nursing of the child are all of primary importance, and we are able to find definite information on all three. But in the ordinary public health or medical text-books, we look in vain for definite guidance on the relation between the habits and nutrition of the mother and the life history of her child. On the related question of monstrosities and developmental disturbances due to injury we have the learned work of Dr. Ballantyne—a mine of precise observation and research.

What we here desiderate is definite information on the conditions that best promote the production of healthy and vigorous children; for unless children are healthy and vigorous at birth, the problem of their after-nurture becomes vastly more critical. The factors that we should expect to count for most are these—the age of the mother, her health history, her actual condition as to specific diseases, her nutrition, her food, her domestic labour, her opportunities for rest, her housing, her freedom from shocks. Of these some are easily ascertained; the others it may be impossible to ascertain. But when it is clear that the seeds of feebleness, of wasting diseases, of imperfect development, may be due to mal-nutrition or injury during the long period of ante-natal life, definite knowledge on the factors here named seems at least worth seeking for. The food question after birth cannot be solved until the food question before birth is made more intelligible.

3. *Experimental Results.*

Experimental research on this great problem does not appear to have gone very far. But in the *Lancet* of July 4, 1903, Dr. Noël Paton, F.R.C.P.Edin., superintendent of the Research Laboratory of the Royal College of Physicians, Edinburgh, and lecturer in the Edinburgh School of Medicine, has recorded some very definite facts on "The Influence of Diet in Pregnancy on the Weight

of the Offspring." Dr. Noël Paton, whose researches on the food of the poor in Edinburgh are now familiar to all students of diet, was led into the present investigation by the facts recorded in the earlier research. He states:—

"In the course of a study of the families of the poorer labouring class in Edinburgh, it became evident that poverty and the resulting deficiency in diet tell most severely in the early years of married life when a number of young children have to be provided for. As the children grow older, their earnings increase the family income and remove the pinch of poverty. In this class every individual thus runs the risk of suffering from deficient nourishment at two periods—during the early years of childhood and during the first few years of married, and, in women, of child-bearing, life. The further questions are thus raised:—How far does malnutrition of the mother during pregnancy influence the growth of the child? Do the children of the poor and badly-nourished start life at a lower level than the offspring of those who are better fed?"

An indirect answer to the second question is indicated by the figures recorded on page 207.

Dr. Noël Paton continues:—"Prochownick, whose object was to determine if by reducing the diet of the mother the size of the child may be so diminished that labour should be facilitated in cases of narrow pelvis, concludes that by restricting the diet of the mother the size of the child may be markedly diminished. He gives 48 cases in which, as the result of such regulation of the diet, the average weight of the child was—in 24 males, 2960 grammes, and in 24 females, 2735 grammes. In 8 cases in which the sex was unstated (excluding a case of twins) the weight was 3354 grammes. The average weight given in Vierordt's 'Daten und Tabellen' for normal infants is—males, 3333 grammes; females, 3200 grammes; average of both sexes, 3250 grammes. Thus, in Prochownick's series the male children were 11 per cent. under the average and the females were 14 per cent."

In order to eliminate the disturbing factors of physical and mental stress and prematurity of birth, Dr. Noël Paton experimented with guinea-pigs.

In a series of guinea-pigs, well-fed during pregnancy, he found that the average litter was 2·7; that the weight of young per gramme of mother was 0·35.

In a series of guinea-pigs, under-fed during pregnancy, he found that the average litter was 2·5; that the weight of young per gramme of mother was 0·25. "In none of these was the weight of young per gramme of mother equal to that in the well-fed guinea-pigs, the heaviest litter in an under-fed animal being 10 per cent. less per gramme of mother than the smallest litter in the well-fed animals. The average weight of the litter was no less than 31 per cent. below that of normal animals. In no case was there any indication that the births were premature, the young animals always presenting the character of full-time guinea-pigs, and being active and vigorous."

The general conclusion is that "the size of the offspring depends very directly upon the diet and nutrition of the mother during pregnancy." This "also probably helps to explain the very high infant mortality among the very poor. The infant starts life at a low level, and readily succumbs to the hardships to which it is too often subjected."

4. *Industrial Occupation of Mother as affecting Offspring.*

Some facts of a more or less precise order have been collected to show the effect of maternal occupation on the life-history of the child. The effects of occupation during pregnancy have not been clearly separated from the effects, direct and indirect, on the child after birth. But the differences between the infantile mortality in communities where the mothers are at work and in the communities where the mothers are relatively at rest during pregnancy and suckling are so enormous that it is not unreasonable to attribute some part of the infantile decrepitude or death to the injurious effects of occupation during pregnancy.

In this connection, Dr. Templeman, medical officer of health, Dundee, says:—

"Another prolific source of infant mortality is the employment of women up or near to the full term of pregnancy. The evil effects of this must be apparent in the offspring, and there is no doubt that this largely accounts for the fact that in Dundee we have every year somewhere about 200 children dying within a short time of birth of what is returned as 'premature birth or debility.' In some parts of Switzerland, the employment of women within six weeks before or six weeks after confinement is made illegal, and during this time their wages are paid, if steady workers in any factory, with a partial deduction. In the case of one factory, this resulted in the reduction of infant mortality by 13 per cent. The Factory and Workshop Act of 1891 contains a provision that the occupier of a factory or workshop shall not knowingly allow a woman to be employed therein within four weeks after she has given birth to a child. Where workers, however, are in the habit of frequently changing their employment, the enforcement of this provision is often impossible. All these conditions arise out of the ease with which women obtain employment in our mills and factories. In Dundee, for example, in 1881 19·4 per cent. of married women were so employed, and in 1891 24 per cent., or an increase of 4·6. I have no more recent statistics on this point. Do not imagine that I would advocate that increased difficulties should be placed in the way of women obtaining employment, but it is not a pleasing reflection at the end of the nineteenth century that so many married women have to earn a livelihood for themselves and their families. It is not easy to suggest a remedy for this. It may be that this hardship on infant life is part of the price we have to pay for our industrial supremacy."—(Child Mortality in Dundee, 1898.) *

* Section 17 of 1891 Act is now embodied in Factory and Workshop Act, 1901, sec. 61:—"An occupier of a factory or workshop shall not knowingly allow a woman or a girl to be employed therein within four weeks after she has given birth to a child."

5. *Conclusion.*

These facts are enough to show that the economic condition of the parents has a distinct bearing not only on the immediate feeding of the school child, but also on his whole history both before and after birth. To be complete, therefore, the medical examination of a school child should be carried through in the light of all the facts available. Housing is thus seen to rise in importance. Economic conditions cease to be questions of money; they become definite biological stresses. Occupation of the mother no longer remains a matter of curiosity; it has a primary significance for the health of her offspring. For these and the like reasons, we do not hesitate to emphasise the importance of recording all the information available on the housing, the occupation, and the feeding both of parents and of children.

CHAPTER IV.

The Effects of Soil and Climate.

1. *Relation of Soil to Disease.*

By the researches of Buchanan, phthisis has been shown to have a definite relation to damp and retentive soils. Cholera, diarrhœa, rheumatism, enteric fever, diphtheria, anthrax, tetanus, goitre, and cretinism, and some other diseases, have all been, more or less conclusively, correlated with the temperature, or the impurity, or the specific contamination, or the moisture of soils. The influence of soil on the healthiness of houses is a commonplace of preventive medicine.

These generalities suggest that, for any given school community, the relative prevalence of soil diseases should be systematically ascertained. This is a primary matter in the public health of a locality; the public health reports will, from time to time, afford evidence of the soil conditions, and the examination of children at school will equally afford confirming or rebutting evidence. Although, therefore, the medical inspector of a school may not be able to make an exhaustive investigation of local soil diseases, he should take what means there may be of relating the ascertained diseases of a school to the ascertained conditions of the soil. He will thus, on occasion, supplement the work proper to the public health authorities.

2. *Influence of Climate on Growth.*

The influence of climate on growth does not seem to be constant. The Patagonians, in a very cold climate, attain to a great stature; the negroes of the Guinea coast, a very warm climate, also attain to a large development.

This by itself only indicates that race predominates over climate. Until, therefore, more extended experiments have been made it is not possible to draw comprehensive conclusions. Still less legitimate would it be to look for differences produced by climate on any particular group of school children. For the purposes of medical inspection of schools, the direct effects of climate on growth may be practically neglected. But the indirect effects are not entirely negligible. These indirect effects, however, are extremely difficult to define. They would include the effect of climate on the food-supply, the correlation of climate with poverty, the resulting insufficiency of clothing, the want of sufficient fat in the food available in an isolated cold climate, &c. It will at once be seen that these vague generalities require more proof than the facts hitherto available afford. Food and clothing cannot be neglected; they have a direct influence on nutrition and, therefore, on growth. But so far as they, both or either, may be affected by climate, the conditions all over Britain are, on the whole, so uniform that differences due to local climates as such count for little. In the more remote islands, however, we should be prepared for local variations due indirectly to climate. These variations will be mainly the result of variation in the food-supply. Whether such variations exist and how far they deviate from the life of the mainland within range of the railway are problems that may themselves ultimately be solved by the facts accumulated under a systematic medical inspection of school children.

3. *Relation of Climate to Disease.*

The relation of climate to health and disease is extremely difficult to determine. The most that can be done to determine it is to watch and record the effects of certain defined climates on particular diseases and constitutions. For the purpose of medical inspection of schools, climate cannot be regarded as of primary importance, but it may be expected that the analysis of school diseases will reveal from time to time definite effects. In

the treatment of disease climate is of vastly more importance than it is in the production of disease. Each locality has its own virtues or vices.

According to Dr. Herman Weber and Sir Michael Foster—"The climate of a region or site is the combined effect of the atmosphere and of the nature of the surface in their relation to man. Of these the atmosphere, which is the product of many more or less varying agencies, is the chief. The most important qualities of the atmosphere are:—(1) The chemical composition; (2) the organic and inorganic substances floating in it; (3) the temperature and its variations; (4) the degree of humidity; (5) the diathermancy; (6) the transparency and the quality of light; (7) the density and pressure; (8) the electrical conditions; (9) the circulation of the air, the direction and the force of the winds.

"The climatic character of a locality depends chiefly on (1) the distance from the equator; (2) the elevation above the sea; (3) the relation of its position to adjacent seas or large inland lakes, or deserts, or marshes; (4) the predominating winds; (5) the nature of the soil, whether rock or dry, porous ground, such as sand, allowing rapid percolation of moisture, and enclosing between the solid particles a large amount of air, or stiff, more or less impermeable ground, such as clay, peat, or marsh; (6) configuration of surface, the amount of shelter, the position on a slope, terrace, plateau, or in a valley, the aspect towards the sun, or possible amount of sunshine; (7) the mode of cultivation of the soil, whether arable fields or pasture, the planting and clearing of forest, the density of population, the establishment of manufactures, the amount of drainage of the urban and the rural districts."—("System of Medicine," Albutt; "Climate in the Treatment of Disease," vol. i., 247.)

In each locality, some one or other of these factors will predominate, and will accordingly affect the children of the schools. But how much can be legitimately assigned to climate is a specific problem in each case. The medical inspector as such cannot exhaustively deal

with the climate of any locality, but he will, as a rule, be able to interpret some of his facts in the light of knowledge locally available from the public health or meteorological reports. The grosser elements of the climate he will always be able to ascertain; for example, the variations in temperature, the height above sea-level, the nature of the soil, the relation to the sea, the prevailing winds, and the leading manufactures that would affect the constitution of the atmosphere. In this way, he may be able at once to use and to supplement the work of the public health department of the district. As an admirable example of how to discriminate the part that climate plays in the prevalence of certain ailments we may instance the "Evolution of the Public Health Function in Glasgow," by Dr. J. B. Russell, medical member of the Local Government Board for Scotland. He there shows that, after all that sanitation in the more limited sense can achieve has been achieved, there will remain the irreducible minimum of deaths and diseases either produced by the special climate of the locality or aggravated by it. The death-rate of Glasgow is not unaffected by the fact that Glasgow lies in the bottom of a humid valley. Dr. Russell shows by the method of elimination how much of the death-rate of Glasgow may be assigned to this fact.

Perhaps for school inspection purposes, the best way to state the case would be that the diseases discovered in any particular group of children ought to be used as a clue to the specific qualities of the climate, as a hint towards the investigation of the climate, rather than as an evidence of the effects to be expected from the known conditions of the climate. At the very least, the school inspections may be reasonably expected to contribute on occasion something to the illumination of climatic effects.

Other indications of differences of climate and their relation to health are to be obtained from the movements of the city populations in the summer season. These movements mark out the great traditional results of experience. Every place frequented by crowds from the city has some specific quality that attracts. That houses

should be built on the margins of certain sea lochs, or on the slopes of hills, or in sheltered valleys, is not an accident. It will always be found to have, or to have had, its origin in some convenience of situation, or some attraction of aspect, or some virtue of climate. This is, of course, more marked in the small villages of recent origin. But whatever be the origin of the resorts prepared for the free person of the city, his movements will always afford a hint of the prevailing experience of particular places. The instinct that demands relief once a year, or oftener, from the effects of the dust, noise, and other exactions of city life has by tradition become very specific in its satisfactions, and though it may not always be correct, it always has something to justify its choice. The holiday effect of climate is not the same problem as the effects on the permanent resident, but the holiday effect is always a fresh experiment; for change of climate and exchange of climate are one and the same. Consequently, the specific effect of climate on the permanent resident may to some extent receive illumination from the seasonal migration of the city visitor.

As an illustration of the use that may be made of climate for school ends, there is Switzerland. In the Canton of Zürich and elsewhere children that are too feeble in health to profit fully by the lowland school climate are sent for periods of a week, or a month, or two months, or longer, to a hill school, where they are systematically nurtured back into health and vigour. Their education, meanwhile, is not neglected. They are taught as fully as the condition of their health indicates, and when they have re-attained to their normal condition, they return to their home school. The "fresh-air fortnight" is, as it were, exploited for the ends of education. There is no reason why, in Scotland, the same exchange should not become a common practice in the city schools.

On the general effects of climate, Dr. Theodore Williams says:—

"One of the greatest arguments in favour of mountain climates is the well-known immunity from the greater

number of diseases mountaineers enjoy and the general vigour of body that they possess. When we contrast them with lowlanders the comparison is almost always in favour of the former, who are generally taller, with broader and deeper chests, and greater powers of endurance, especially in marching and walking; these characteristics are present in mountain races over the whole globe, be they the natives of the Himalayas, the Indians of the Andes, the chamois hunters of the Tyrol, the guides of Switzerland, or the Highlanders of Scotland. The immunity from phthisis which has been so strongly insisted on by Kuchenmeister and others, has not been found to be so complete as he has set forth; nor is there any fixed immunity altitude for each degree of latitude, as he would infer; and experience shows that unhealthy modes of life, insufficient food, ill-ventilated dwellings, and pernicious habits will produce phthisis at any altitude and in any latitude, but that if these are avoided undoubtedly an altitude of 5000 to 6000 feet above sea level will exercise a decidedly protective influence against phthisis, even in those predisposed to that disease. The only diseases which the mountain climates can be said to produce are the so-called 'mal-des-montagnes,' already described, and a form of dry pleurisy, known in the Alps as Alpenstick; but while they largely benefit phthisis and other strumous affections, they are injurious and consequently contra-indicated in the following:—Emphysema, chronic bronchitis and bronchiectasis, diseases of the heart and great vessels, of the kidneys and of the liver, diseases of the brain and spinal cord, and all states of hyper-sensibility of the nervous system; the catarrhal and laryngeal varieties of phthisis as well as erethric phthisis, when there is great irritability of the nervous system, and all cases of advanced disease of any kind.

"On the other hand, the benefit of mountain climates is immense in the following:—Cases of strong hereditary predisposition in which phthisis is either threatened or in a state of early development; hæmorrhagic phthisis; chronic tubercular phthisis in its various stages, provided

the lung surface be not too largely involved to admit of proper aëration at high altitudes, and there be no pyrexia; chronic pleurisy where the lung does not expand after the removal or absorption of the fluid; and chronic pneumonia, without bronchiectasis, that does not resolve; anæmia, and spasmodic asthma without any considerable amount of emphysema." — (Stevenson and Murphy's "Hygiene and Public Health," i., p. 221.)

In the Aberdeen and Edinburgh investigations, no attempt was made to isolate the effects of climate, and the extreme complexity of city life would have made any inference from the small numbers unsafe. But for the study of the climates of the two cities there is abundant material at hand. In his periodic reports, Professor Matthew Hay has for a long series of years correlated the leading facts as to disease and death with the local meteorology. Similar facts may be obtained for the city of Edinburgh, and a comparison on the large scale is thus made possible. But in the particular investigations, causation of disease did not bulk so largely as the character of it. Had the research been conducted on a larger scale with the view of completely grounding ultimate conclusions as to health and disease, the effects of climate would have been considered in detail.

CHAPTER V.

THE EFFECTS OF HOUSING.

1. *Selection by Housing.*

HOUSING is unquestionably one of the most important factors affecting the school child. The housing not only affects the health of the individual child, but also indicates more definitely perhaps than anything else the social grade he comes from. The population of the one and two-roomed houses of our great cities is different in almost all its characteristics from the population inhabiting houses of four rooms and upwards. The presence of the one and two-roomed houses in any part of a community tends to attract the less efficient, the less fit of every class. Sometimes it is said that the one-roomed house produces the type that inhabits it. This is in some sense true. It would be more exact, however, to say that the type capable of living in the one-roomed house naturally drifts to it. The experience of the great cities, for example, Glasgow and London, shows that the one-room inhabitant is a necessary by-product of prevailing economic conditions. He goes to his one-roomed house because he has neither the money to pay for anything better nor the character necessary for the earning of the money. Disease, it may be, has impaired his economic efficiency; from fit he has passed among the unfit, and as he may have been working upon a narrow margin, he finds himself obliged to fight on a lower level. Ultimately, even the struggle on the one-room level may be too great; he then gives up the effort and forthwith passes into the arms of the parish council. It is obvious, there-

fore, that the one-roomed population means as well those that have naturally found themselves unfit to develop the energy necessary for better living as those that have fallen from higher grades. The one-room population tends thus to move in a vicious circle, the house attracting the inefficient man, and adding to the inherited inefficiency of the child.

2. *The Relation of Housing to the Death-Rate.*

The effect of housing on the death-rate has been well studied. In the elaborate investigation made by Dr. J. B. Russell into the ticketed houses of Glasgow, it became evident that, on the large scale, as the houses diminish in size the death-rate of their population increases. In the one-room population, the death-rate was found perceptibly higher than in the two-room population, and in the two-room population, it was perceptibly higher than in the three-room.

This general fact has been confirmed in other cities. It fulfils the physiological forecast. Recently, the figures for Glasgow have been investigated anew by Dr. Chalmers, medical officer of health, Glasgow. What on other grounds we might have inferred as to the effects of one-roomed houses on health is set forth as actual fact and inference from fact. Let the point of view be altered as we will, the central truth remains identical—the one-roomed child is the child of inefficiency, and by the one room his inefficiency is increased. The one-roomed house becomes a definite agency of selection. It offers a chance for the survival of a type that in ordinary circumstances could not exist.

The effect of the one-roomed house is doubtless shown most decisively in houses strictly limited to one room. But the house of one room is really the structural expression of a practice that is common enough in houses of more than one room. Those that live in houses of two or three rooms do not, as a rule, use all the rooms equally. They practically, and to a less extent in the country, confine themselves to one. Nor this only. In the cities

they frequently sub-let each of the two rooms and sometimes divide with a lodger the space available in the third. Consequently, a considerable percentage of the two or three-roomed houses may always be reckoned as physiologically equivalent to one-roomed houses. What the percentage in any particular city may be is a matter for detailed investigation. Theoretically, the data necessary to determine the point would include, for any given area, a complete record of one, two, and three-roomed houses, complete information as to the number of residents in each room, and the amount of cubic space available per head. Occasionally it is possible to obtain these data with great exactitude; but the results of such an analysis as Dr. Chalmers has made of Glasgow are likely to be much more stable and more illuminative for practice:—

"Were it necessary to warn this audience against the errors of statistical inference, I should plead in defence of the limited time over which the rates have been calculated, the circumstance that only once in ten years are they available on a similarly ascertained basis, and that the range of probable error therein can be more accurately estimated than were I to have assumed the constancy of a population-factor over a period of years, with the knowledge that its proportions are gradually changing, and especially that in one-apartment houses it is decreasing.

"In dealing with the death-rate of large areas it is customary, as you know, to sub-divide the total population into groups, with the object of ascertaining variations in the rate, which might reflect differences in the sanitary surroundings of each; and when we state the death-rate of Glasgow during last decade at 21·15 per 1000, it is qualified by the knowledge that among the 33 sanitary sub-districts into which the city is divided, the rates range from 8 per 1000 in Kelvinside, and 9 in Pollokshields West, to 31·8 in Brownfield and 32·7 in Cowcaddens. It is right, however, to observe—although we need not linger over the fact—that variations in a death-rate may arise from circumstances not related to sanitation at all. The death-rate among male children under five in Glasgow,

according to the New Life Table, was 86 per 1000 living at these ages, and of female children 75, so that two populations, in which these formed a larger or a smaller proportion, might have their death-rates increased or decreased without of necessity implying that their circumstances otherwise were different.

"And as children at these ages form only 6 per cent. of the population of Kelvinside and Pollokshields, but nearly 12 per cent. of the population of the city as a whole, we should have to make correction for these differences before comparing the district rates with that of the city.

"But in the present inquiry the endeavour has been, in the first place, to eliminate as far as possible the effect of external conditions, and to ask what part the house —considered simply as a place of residence—plays in the life history of its inmates, and to what extent its effect becomes an appreciable factor in the production of our death-rate.

"For this purpose I have taken the population of the city at last census, and arranged it in groups, distinguishing between the numbers occupying one, two, and three-apartment houses, and those of all other sizes, and against each group I have placed the deaths occurring during the census year, 1901, and their equivalent rates on the following page.

"The contrast here presented in column 3 at once arrests attention. In a year in which the death-rate for the city was barely 21 per 1000, it is scarcely exceeded by that of our two-apartment population (which forms 47 per cent. of the whole) and not measurably approached in the population occupying houses of larger size. Yet in this same year the rate among the one-apartment population is 33 per 1000, and this not in one district only, but calculated over nearly one-seventh (14·05 per cent.) of our population, distributed widely throughout the city.

"In houses of all other sizes taken together, it only slightly exceeds 17, and barely reaches 19 per 1000 when

TABLE I.

GLASGOW, 1901.—DEATHS AND DEATH-RATES FROM "ALL" AND "CERTAIN" CAUSES IN HOUSES OF SEVERAL SIZES.

(1)	(2)	(3)		(4)		(5)		(6)	
SIZE OF HOUSES.	Census Population.	All Causes.		Zymotics.		Phthisis.		Respiratory Disease (including Croup).	
		Deaths.	Death-rate per 1000.	Deaths.	Death-rate per 1000.	Deaths.	Death-rate per 1000.	Deaths.	Death-rate per 1000.
1 Apartment, - - - -	104,128	3,405	32·7	771	7·4	247	2·4	792	7·6
2 Apartments, - - - -	348,731	7,418	21·3	1,576	4·5	620	1·8	1,600	4·6
3 Apartments, - - - -	151,754	2,081	13·7	290	1·9	178	1·2	362	2·4
4 Apartments and up, - -	136,511	1,533	11·2	139	1·0	99	0·7	272	2·0
Institutions and Harbour, -	20,588	1,072	—	88	—	152	—	235	—
Not Traced, - - - -	—	207	—	10	—	48	—	41	—
CITY (including Institutions and Deaths not traced), - -	761,712	15,716	20·6	2,874	3·8	1,344	1·8	3,302	4·3

the institutional and shipping population and deaths are included with them.*

"It is scarcely necessary further to emphasise the contrast, but it may help us to appreciate the volume of our population to which this excessive death-rate of 33 per 1000 applies if I suggest a few comparisons.

"Taken collectively, in our one-roomed houses we have a population which in number exceeds that of any of the large town populations of Scotland, and among the principal towns is only surpassed by Edinburgh, Aberdeen, and Dundee; it equals in volume three times the combined population of our four worst sanitary districts, Cowcaddens, Port-Dundas, High Street and Closes East, and Brownfield; and in the year with which I am dealing the death-rate was exceeded in only two of them, Brownfield and Cowcaddens.†

"It may well happen then that the contention of the critic that reduced death-rates are not necessarily or even generally accompanied by a corresponding improvement in general health, in reality means that the hygienic advance in recent years has been unequal, and that it has failed to reach no inconsiderable section of our town populations. If this be the case, it is of the most vital importance that we should realise it.

"QUESTION OF AGE DISTRIBUTION OF ONE-APARTMENT POPULATION.

"What is the age distribution of our one-apartment population? Here, unfortunately, direct information is awanting, and we are in danger of travelling in a circle. Moreover, the question is an important one, for it would be easy to construct an artificially-arranged population,

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*	Population.	Deaths.		
1 Apartment,	104,128	3,405,	D/R p. 1000,	32·7
2 Apartment and upwards (including inst. and shipping),	657,584	12,253,	,,	18·6
CITY,	761,712	15,658		20·6

† In Brownfield, with a population of 3924, the death-rate in 1901 was 40·4; and in Cowcaddens, with a population of 18,206, the rate was 33·4 per 1000.

among whom a death-rate of 30 per 1000 might quite reasonably occur without attracting special attention. I have already referred to the disturbing effect of a varying proportion of children under 5 years of age.

"On the other hand it might be assumed, and indeed it has been suggested, that our one-apartment population consists largely of widows or aged couples whose children have left the parental roof. The death-rate for males in Glasgow, at ages from fifty-five to sixty-five, is 45 per 1000 (New Life Table), and of females from forty-five to fifty-five, it is 21, so that again, with the proportion of the sexes which we have in Glasgow, were these houses so occupied, a death-rate approaching 30 per 1000 could not be regarded as excessive. But a scrutiny of the age periods at which the deaths in one-apartment houses occur, prevents us from assuming that they are occupied in excessive proportion by persons in advanced years, among whom a high death-rate might be expected. If we assume that our one-apartment population is similar in its age distribution to the average of the city, we shall be probably not very wide of the mark.

"If we confine our attention to the deaths occurring under 5 years, the contrast which the columns present might arise from a larger proportion of children at this age among our one-apartment population, or from a higher rate of mortality prevailing among them, but in either case it would be fatal to the contention that the excessive death-rate of the one-apartment population as a whole is to be explained by causes natural to advanced life. Moreover, the figure which represents the number of deaths among infants (1093) has its significance increased by considering the proportion which they form of the total infantile deaths occurring in the city. In the year 1901 these numbered 3602, so that 30 per cent. of our infantile deaths occur among the 14 per cent. of our population who inhabit our one-apartment houses. Apart from the operation of extraneous causes, this would require that the proportion of infants therein should be more than twice that of the city generally, which, to say the least, is unlikely."

TABLE II.

GLASGOW, 1901.—DEATHS IN ONE-APARTMENT HOUSES AT CERTAIN PERIODS OF LIFE, WITH PERCENTAGE OF TOTAL DEATHS AT EACH AGE PERIOD, AND FOR COMPARISON THE PERCENTAGE OF DEATHS AT THE SAME AGE PERIODS IN HOUSES OF OTHER SIZES, EXCLUSIVE OF INSTITUTIONS, AND IN THE CITY AS A WHOLE.

AGE PERIODS.	Deaths in 1 Apt. Houses.	Percentage of Total Deaths.		
		1 Apt.*	2 Apts. and up.*	Whole City.
Under 1, - -	1093	32·1	21·8	22·9
1 and under 5,	850	25·0	16·5	17·8
5 ,, 15,	131	3·8	5·8	5·1
15 ,, 20,	37	1·1	2·7	2·3
20 ,, 25,	87	2·6	3·5	3·1
25 ,, 60,	760	22·3	30·3	29·6
60 and up, - -	447	13·1	19·4	19·2
	3405	100·0	100·0	100·0

* Excluding institutions and harbour.

The conclusions indicated by these figures for the whole city are confirmed when the facts for each leading group of districts are placed in correlation. Where the percentage of one-room population is highest, the general death-rate is highest, and the death-rate of the one-room population is highest. Thus, to take a single illustration:—Group I. includes the districts of Brownfield, Cowcaddens, Port-Dundas, High Street and Closes East. "The lowest district death-rate of the group is 30 per 1000; the highest, 36·4. The total house population is 33,642; the one-apartment population, 7685, or 22·8 per cent. The death-rate in houses of all sizes (excluding institutions and shipping) is 31·1 per 1000. Among the one-apartment population it is 41·2."—(*Ibid.* p. 16.)

In the other four groups of districts, the one-apartment population constitute, in sequence, 22·6, 18·2, 10·8, and 5·6 per cent. of the total populations of the respective groups. In the same order, the death-rates in houses of all sizes were 22·9, 18·9, 15·9, 13·0—a descending series. The death-rates in the one-apartment populations of those groups were, in the same order—35·9, 30·5, 33·1, 25·4—the interruption in the descent of the sequence being possibly, but not certainly, due to differences in age distribution.

These facts are alone enough to show that the effect of housing on health and the production of disease is of the most intimate kind. Where overcrowding is greatest, there also the death-rate is greatest. Where the concentration of organic poisons is at a maximum, there also the disease-rate is at a maximum. Whether the one-room population is generated by the one-room house, or whether the one-room house is merely the special agency of selection, a possible environment for the varieties fit to live in it, the general result is the same—wherever the one-room house is established the death-rate is high.

3. *Relation of Housing to Health and Disease.*

Now, if the one-roomed house is directly and indirectly the cause, or, let us say, the sign of a high death-rate, it will also be the cause of a high disease-rate, that is of the gross affections that come within the medical nomenclature. Short of the ill-health that can be named and classified, there is the general interference with nutrition that shows itself in the form of interrupted or retarded growth. For the one-roomed house carries with it much more than physiologically insufficient air-space. The one-roomed house means in general less than normal food. It may even mean an environment of starvation. It almost always means poverty of the parents. And this means inadequate nurture of the child. The one-roomed house thus becomes an index not only of the direct effects due to overcrowding and the filthiness that necessarily follows from it, but also the effects of under-feeding,

under-clothing, and, in general, all that goes to constitute ill-nurture. Under-feeding and under-clothing have their roots in the same social causes, and physiologically they are near of kin. In the towns, the one-roomed house, except when it is superintended effectively by disinterested organisations, is the focus of all the forces that affect for evil the nutrition of the child at the most delicate periods of his development. Of this the high death-rate is the very gross and unmistakable proof. Death is the climax of bad nurture.

In the examination of the North Canongate School children, this was made so manifest that a detailed analysis of the total number of children in relation to housing was not necessary. The broad results in contrast with the other schools were too striking to need more than a statement. In Aberdeen, where the individual schools were less strikingly contrasted than in Edinburgh, Professor Matthew Hay has presented in his report a detailed analysis of all the children in relation to the housing. This table is of immense value as an indicator of the kind of results to be looked for. What is not obvious from the primary examination of individual children becomes evident when the totals are placed in correlation. Health is relative, and the indications of degrees of unhealthiness—personal appearance, pallor, diminished weight, &c.—are in every way as reliable as the presence of gross disease. These indications are sufficiently exhibited in the Edinburgh and Aberdeen reports, and are strongly emphasised by the Royal Commission. If they stood alone, the facts even for the 1200 children examined would be too limited to warrant final conclusions. But even in their own kind they do not stand alone. And they are everywhere in confirmation, not in contradiction, of the general facts otherwise known to follow from inadequate housing and the inadequate nurture it implies. The facts of the reports thus acquire more than a local value. At the very least, they offer enough of positive result to show that the investigation of the housing of the school child is of primary importance

in the medical inspection of the school. The life of the school child is seriously and intimately affected by the physiological conditions of his home. Hence it is absolutely essential to thorough inspection of the child that his housing should be minutely recorded. It will not as a rule be possible to ascertain more than the number of rooms, but the value of this fact is not inconsiderable. The medical inspector will confirm or correct his impression from the many returns available. It is necessary thus to insist on the importance of housing, because it is habitually regarded as a matter solely for the public health organisations. These, it is true, are continually accumulating precise facts on the housing of the people, but the more the facts of the school child's life are studied the more are they seen to involve the conditions of his nurture at home. If to the number of rooms the medical inspector is able to add the full details of sanitation, economic status, wages earned, income, and outlay, &c., so much the more complete will be his estimate of the health condition and fitness of each individual child. Medical inspection at school will thus steadily rise in value. It will be an examination of the recruits of all the armies, civil and military, at a stage when their examination may lead to the improvement of their nurture.

We now quote some leading facts from the Edinburgh and Aberdeen reports, and from the report of the Commission :—

(*a*) *From Edinburgh Report.*

"*Rooms.*—In the allocation of rooms, 586 pupils have been considered. In the remainder of the 600 no correct returns were given.

"The percentage of children living in *one-roomed* houses was, for the separate schools, as follows :—South Bridge, 4·7 ; London Street, 11·3 ; North Canongate, 20 ; and Bruntsfield, 2·1.

"In *two-roomed* houses the percentages were—40·5, 30·6, 56·6, ad 11·6 respectively.

"In one-roomed and two-roomed houses, taken together, the percentages were—45·2, 42, 76·6, and 13·7 respectively.

"In *three-roomed* houses, the percentages were—36·4, 33·3, 21·3, and 29·7 respectively.

"In *four-roomed* houses the percentages were—13·5, 10·6, 1·3, and 26·8.

"In houses of five rooms and upwards the percentages were—4·7, 14, 0·6, 29·7.

"From these figures it is evident that the children attending North Canongate are the worst housed. The percentage living in one-roomed houses is larger, the percentage living in two-roomed houses is larger, the percentage living in three-roomed houses is 21·3, as against 36·4, 33·3, and 29·7 for the others. The percentage living in four-roomed and five-roomed houses is only 1·3 and 0·6 respectively—a mere vanishing quantity.

"If we classify schools according to the percentages of children living in houses of three rooms and upwards, we find that Bruntsfield is easily first with 86·2 per cent.; London Street second with 58 per cent.; South Bridge third with 54·7 per cent.; and Canongate last with 23·3 per cent. The contrast between the first and last is very striking, and it was seen to be equally marked at the other end of the scale, Bruntsfield yielding as few for the one-roomed houses as Canongate does for the four and five-roomed. In the subsequent tables, it will appear that the contrast between Canongate and Bruntsfield is reflected in the weights, heights, nutrition, and some other respects.

"If we take the schools as a whole, we find that the percentage of children living in one room is 9·73; in two rooms, 35·32—or a total of 45. The remainder live in houses of three or more rooms.

"*Comparison of Schools for Weight and Height.*—The differences between the schools are shown by the weights and heights. The contrast between North Canongate on the one hand and Bruntsfield on the other is too striking not to be dealt with in some detail. From other facts in the other tables, the condition and constitution of the

school population in each of these schools have been set forth. It has been found that in North Canongate, the percentage of children in one and two-roomed houses is vastly greater than in Bruntsfield. The cubic space per child is less. The percentage of stout children is less. In fact, taken generally, the children of North Canongate have been shown to occupy a worse position than those of Bruntsfield in the following respects—nutrition, alertness, amount of ear disease, amount of throat disease, cleanliness of body and clothing, and some other minor matters. On the other hand, Bruntsfield has shown a greater total of lung troubles, a fact not to be expected and not easy to explain.

"In support of these general conclusions, we have the weights and heights.

"For children of six to nine, the comparative weights are as follows:—Males, North Canongate, 43·85 lbs.; Bruntsfield, 49·23; females, North Canongate, 40·45 lbs.; Bruntsfield, 50·63. There is thus a difference in favour of Bruntsfield of 5·38 lbs. for males and 10·18 lbs. for females.

"For children of nine to twelve, the figures are:—Males, North Canongate, 56·49 lbs.; Bruntsfield, 62·49 lbs.; females, North Canongate, 55·91; Bruntsfield, 58·99. There is thus a difference in favour of Bruntsfield of 6·00 for males and 3·08 for females.

"For children of twelve to fifteen the figures are:—Males, North Canongate, 70·38 lbs., Bruntsfield, 75·62; females, North Canongate, 72·63; Bruntsfield, 85·01. There is thus a difference in favour of Bruntsfield of 5·24 for males and 12·38 for females. But this is partly accounted for by the fact that a full complement of the fourteen to fifteen ages was to be found at Bruntsfield alone. Compare average less these ages.

"These differences are very great. But they correspond with the general impression of the superior nutrition of Bruntsfield. Even if we allow a small difference for the difference in weights of clothing—and the clothing of North Canongate children was markedly deficient—the

margin against North Canongate is still very large. Among the factors that produce these differences, housing and food must be regarded as the chief. Race can scarcely count for much. My impression is that the races are more defined in the Canongate, more amalgamated in the Bruntsfield, population. But the differences of weight cannot be assigned to race. Neither can they be assigned to differences in physical training. So far as I could judge, the amount of training is approximately equal in both schools. But it must not be forgotten that the existence of such a class as these children of the Canongate are drawn from pre-supposes a long process of social selection. Into that class the thriftless and the inefficient of every variety tend to drift. On the other hand, the population of Bruntsfield School is supplied from a class selected by labour and occupation, which means greater physical efficiency. Consequently, the children of North Canongate are, to begin with, born from a class of distilled inefficiency. The hereditary factor must, therefore, count for something. But even if this is allowed for, the children were under-fed and under-clothed. The younger children particularly had little of the vigour and buoyancy associated with healthy childhood. As to clothing, flannel was rare among the under-clothing. Obviously, the clothing in many cases had been made to fit sizes other than the wearers'.

"These inferences, which are founded on direct observation, are confirmed by the report of the Committee for Feeding and Clothing Destitute Children, 1901, where it is recorded that in North Canongate School 45 children received food and clothing, 137 food only. For the same year, at London Street School, 27 received food and clothing, 36 food only. At South Bridge, 12 received food and clothing, 34 food only. At Bruntsfield, none received clothing, and only 2 received food.

"Recent facts confirm this. Accordingly, I feel justified in concluding that a large minority, if not the majority, of North Canongate school children are habitually under-fed and under-clothed.

"This fact must be taken into account in any estimate of the value and urgency of physical education. The primary necessity is adequate food; the next is adequate clothing. A large number of the 150 children examined at North Canongate had neither. Already I have noted that the amount of physical exercise at this school is approximately the same as at the other schools. But physical exercise unsupported by adequate food and adequate clothing must result in early physiological exhaustion and infirmity. The prematurity of the street gamin means this and little else."

In a further detailed comparison of North Canongate with the other three schools it was found that in height as in weight the North Canongate children were uniformly lowest. The value of this contrast lies in the fact that all the children examined in Edinburgh were, approximately, of the same race composition. In other words, all the groups of children were racially capable of attaining to the same stature and weight; but some groups fell markedly below their potential. Race as a factor is thus practically eliminated; the differences in the groups are due to differences of nutrition.

(*b*) *From Aberdeen Report.*

"COMPARISON BETWEEN CHILDREN ACCORDING TO SIZE OF HOUSE.

"The size of house from which the child comes is one of the most convenient and reliable of available indications of the social condition of the child. In Aberdeen, 30·5 per cent. of the children examined came from houses of one or two rooms, 29·5 per cent. from houses of three rooms, and 40·1 per cent. from houses of four or more rooms.

"According to the last census, roughly one-third of the whole population of Aberdeen was found to be living in each of these three groups of houses. The proportions of the children examined, therefore, represent approximately the social condition of the whole children, except for a preponderance in the proportion of children from

houses of four or more rooms, which was due to the difficulty of getting sufficient children at the ages of thirteen to fifteen in the ordinary elementary schools in the poorer parts of the city. It has, therefore, been thought advisable in the accompanying tables not to carry the comparison beyond the ages of thirteen. Even with this limitation, the numbers for each group at certain ages are too small to be of much service, but a general survey of the table may give fairly reliable conclusions. The comparison is confined to 'mental capacity,' 'state of nutrition,' 'cleanliness,' and certain representative measurements. A separate table is given for each sex.

"In point of *mental capacity*, the boys from one and two-roomed houses were on an average appreciably better than those from houses of four rooms and upwards, who were in turn better than boys from three-roomed houses; but these differences were most pronounced at the early ages, and were almost reversed at the later ages, when the boys from the large houses took the lead, and boys from the smallest houses fell into the rear. The girls from the large houses were, on an average, the best. Those from one and two-roomed houses had, however, the largest proportions of 'excellents,' but also the largest proportion of 'dulls.'

"In respect of *cleanliness*, the children from the smaller houses were, as might have been expected, less satisfactory than those from the larger houses, the proportion of clean children showing a distinct diminution with a decrease in the size of the house.

"As to *nutrition*, the largest proportion of apparently well-nourished children—the sexes being taken together—came from three-roomed houses, and the largest proportion of 'thin' children from houses of four rooms and upwards. These results are derived from the ordinary inspection of the children, and are not so reliable as those deducible from actual measurements.

"In regard to *measurements*, it is obvious from even a hasty perusal of the accompanying tables that, in each sex, the *height* of children from four-roomed houses was,

as a rule, greater than that of children from three-roomed houses, who, in turn, were taller than children from one and two-roomed houses; but this is not the order at every age. For example, at eleven to twelve, among girls, those from one and two-roomed houses were the tallest, but this is the only instance in the male and female tables where this occurs. At several ages, however, children from three-roomed houses were the tallest —viz., among boys, at eight to nine, nine to ten, and ten to eleven. The difference in height between the largest and the smallest housed group at each age varied from 0·6 inch to 2·9 inches, and averaged about an inch for males and 1·3 inch for females; and the difference was practically as pronounced at the earlier as at the later ages. It did not appear to be an increasing difference.

"As regards *weight*, there were corresponding differences to those for height, varying from 0·7 lb. to 7·4 lbs. at each age, and averaging about 3·3 lbs. in males and 3·1 lbs. in females. The differences were not uniformly in favour of children from the largest houses. At two ages—viz., nine to ten and eleven to twelve—boys from three-roomed houses were the heaviest; at the remaining five ages, boys from houses of four rooms and upwards were the heaviest. Among girls, at eleven to twelve and twelve to thirteen, those from one and two-roomed houses were the heaviest; and at eight to nine, nine to ten, and ten to eleven, those from three-roomed houses. At only two ages—viz., six to seven and seven to eight—were girls from houses of four rooms and upwards the heaviest. The difference in weight between the lightest and heaviest group at each age averaged 3·3 lbs. in the boys, and varied at the different ages from 0·7 to 7·4 lbs. In the girls, it averaged 3·1 lbs., and varied from 1·4 to 5·9 lbs.

"If a careful comparison be made in the tables between the weight and height for each age and group, it will be found that the difference in weight usually follows the difference in height, irrespective of age, and also largely irrespective of the group, especially when it is

kept in view that the ratio of weight to height is naturally not constant for all heights, but increases with increasing height. On the whole, however, after due allowance has been made for these considerations, the balance is in favour of children from houses of three and four rooms and upwards, but it is not large.

"There still remains the substantial difference in height already fully detailed, and it is proper to consider whether the inferior height of the children from the smaller houses is due to home conditions. A similar difference has frequently been noted by previous observers, but, while it may be admitted that deficient feeding hinders growth, it must not be too readily assumed that this rather than inheritance is the chief cause of the differences in height observed in Aberdeen. Scarcely any of the children had a starved appearance, and, as already remarked, the apparently 'thin' children were in larger proportion among the children from four-roomed houses than among those from one and two-roomed houses. Moreover, the disparity in height between the different groups did not, as already remarked, advance with increase of age, as might have been expected had home conditions been exercising a continuously deterrent effect.

"It is by no means inconceivable that the average height of persons entering or reaching the upper ranks of life may be somewhat greater than the average height of those remaining or dropping within the lower ranks. The battle is still to the strong. And the extensive observations of the Anthropometric Committee of the British Association show that, on an average, the tall live longer than the short, and are presumably the stronger and healthier.

"These remarks are intended only to show that in Aberdeen the children of the poorer and working classes generally are probably not suffering greatly in physique from insufficient feeding.

"As to the remaining measurements given in the tables, it may be said generally that they showed somewhat similar differences to those already remarked for

height and weight. The balance of advantage rested most frequently with the children from the larger houses, but it was often very slight, when allowance is made for difference in height. In the case of the boys, on an average of all the ages, after such allowance, the advantage belonged, perhaps, to those from three-roomed houses rather than to those from larger houses. This is true of all the measurements except the grasping power of the hand. In the case of the girls, on an average of all the ages, the three groups were very nearly alike, when allowance is made for difference in height."

(c) From Report of Royal Commission.

"The idea suggested by the examiners of obtaining information regarding the housing of the children has proved a fertile one. They ascertained the number of rooms inhabited by the family from which each child was drawn; and while all the school buildings, both in Edinburgh and Aberdeen, were ascertained to be at least fair in respect of plan, ventilation, heating, &c., so that the manner in which each school influenced the condition of the children differed little, one from another, it was otherwise with the houses where the children resided.

"The number of the rooms furnished a good indication of the social status of the children. In Aberdeen, 'the balance, in respect of health and development,' was found to be 'in favour of children drawn from three and four (and upwards) roomed houses,' and that city, most of whose school children were drawn from three-roomed houses,* had the advantage over Edinburgh, whose children were drawn mostly from two-roomed houses. 31·3 per cent. of the Aberdeen children lived in three-roomed houses,* while in Edinburgh, on the contrary, the predominant number, 35·32 per cent., lived in two-roomed houses. Indeed, of all the Edinburgh children, 45 per cent. lived in very small, *i.e.*, one or two-roomed, houses.

* But see p. 170.—Three-room children were 29·5 per cent.; one-room, 30·5 per cent.; and four-room and upwards, 40·1 per cent.

"The ratio of health in both cities harmonises with these facts. Thus there are among all the children examined in Aberdeen 0·5 per cent. in apparent poor health, while in Edinburgh there are 19·17 per cent.

"The same tale is told by the statistics regarding the condition of nutrition of the children. Aberdeen shows 9 per cent. of its children badly nourished, while Edinburgh shows 29·83 per cent.

"And, similarly, mental dulness was noted in 8·8 per cent. of the Aberdeen children, compared with 12·33 per cent. in Edinburgh.

"The same connection between housing and health is apparent in other ways, of which only the fact that in Aberdeen the 'thin' children are drawn in larger proportion from the poorer houses need be adverted to.* The examiners were so impressed by the intimate connection between housing and health, that Dr. Mackenzie remarks that the inferiority in health is not due to defective schools, which are relatively more hygienic than the homes, and that the houses wherein the children live are reflected as to their quality by the height, weight, and nutrition of the children.

"We cannot doubt that the quality of the houses where the children live corresponds, among other adverse factors, with the quality of the food they receive, and assent to the justice of Dr. Mackenzie's comment on the difference between the Bruntsfield and North Canongate Schools (the best and worst of those examined in Edinburgh), where he remarks that 'among the factors that produce' this great deterioration among the children in the North Canongate School, 'housing and food must be regarded as the chief.' Race 'can scarcely count for much.' The verdict is equally true of the difference between Aberdeen and Edinburgh. Race fails to have any apparent bearing on the matter, judged by the cephalic index, one of the most abiding signs of race. Edinburgh, with an index

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* There was considerable variation in the "thin" as tested by weight. (See Part III., chap. III.)

almost uniformly just over 78, should show, were race the chief cause, a less striking contrast between its schools than Aberdeen, where there is more uniformity of conditions among the children of the different schools, though the co-existence of unfused races is greater, as shown by the cephalic index, varying between 81·4 and 78·5."

The detailed comparison here instituted between Aberdeen and Edinburgh must be qualified by the fact (*a*) that the examiners, though proceeding on the same lines, were acting without interchange of observations during the examination; (*b*) that, accordingly, the personal equation counts for something; (*c*) that the selection of children in Aberdeen was made several days, and in some schools one or two weeks, in advance of the examination. On the other hand, the differences between the figures for the two cities are so great that even when a large margin of possible error is allowed, the contrasts tell much the same tale.

4. *Conclusion.*

One final remark. When the figures are minutely studied they tend to show that in all those diseases that depend directly on environment, the child bred in the one-roomed house suffers more frequently, and suffers ultimately more, than the child from houses of greater size. In the skin diseases and the infectious fevers, this is too obvious to need illustration. It is not so obvious, but it is equally true, in the more subtle disturbances of nutrition that lead to anæmia, rickets, foreshortening of growth, and the like. The stress on the one-roomed child is always greater. By overcrowding, he is robbed of oxygen. By parental neglect, he is left uncleaned. By poverty, he is starved of food. By the clamour and nervous stress incident to over-aggregation, he is spoiled of sleep. Unbreathed, under-fed, under-slept, under-clad, over-stimulated, he lives too fast and too much.

CHAPTER VI.

The Effects of Occupation.

1. *Selection by Occupation.*

Occupation is among the best understood of selective agencies. Dr. Arlidge, in his "Diseases of Occupation," has made very clear the effect of particular industries on the respiratory organs, and consequently on the life of the adult individual. Such occupations, however, may not directly affect the school child, except to an infinitesimal degree. The fact that the father has died of the inhalation of steel dust does not necessarily imply any particular susceptibility on the part of the father, or on the part of the child. Consequently, in studying the effects of parental occupation on the life of school children, we should have regard mainly to the local sanitary conditions of housing and soil necessarily incident to particular industries. But apart from individual affections, occupations act in a much more profound way. Certain occupations are very laborious; certain others are very light. The laborious occupations require the stronger men; the light occupations attract the feebler men. For example, the type of man that naturally seeks employment as a working engineer is different from the man that seeks employment as a scavenger. Farm servants differ in type from town artizans, and so on. Accordingly, occupation becomes an automatic means of classifying the population into various grades of strong and weak. Normally, the weakness and the strength are inherited by the children of the respective classes. Consequently, among well-housed, well-paid artizans, who, to begin with, are physically more fit, we should expect to find, and do find, taller, heavier children than among the ill-housed,

lower-labour classes, who, to begin with, come of a more feeble stock. The analysis of occupations thus affords readily applicable means of forecasting the general peculiarities of groups of children.

2. *General Effects of Occupation.*

In the Decennial Supplement for the years 1871-80, Dr. Ogle, late Registrar-General for England, made the following observations:—"There are many trades and occupations which require a considerable standard of muscular strength and vigour to be maintained by those who follow them; such occupations, for instance, as those of a blacksmith, of a miner, and the like; and so soon as from any cause the health and strength of a man fall below this standard he must of necessity give up the occupation and either take to some lighter form of labour, or, if his health be too much impaired for this, retire altogether from work. And even in those industries where no excessive amount of muscular strength is required there must nevertheless be always a certain time beyond which continuance in the business becomes an impossibility. The weaker individuals, and those whose health is failing them, are thus being drafted out of each industrial occupation, and especially out of those which require much vigour; and the consequence is that the death-rates in these latter occupations are unfairly lowered, as compared with the death-rate in occupations of an easier character, and still more as compared with the death-rates among those persons who are returned as having no occupation at all. A very considerable proportion of those who are forced to give up harder labour take to odd jobs of a more or less indefinite character, and are returned both in the census schedule and eventually in the death registers as general labourers, as messengers, or as costermongers, street-sellers, &c.; and thus it comes about that the death-rates of general labourers, of messengers, and of street-sellers . . . appear to be of appalling magnitude, as also do those of persons returned as of no occupation. Under these headings, however, are

comprised the broken-down and the crippled, who have fallen out of the ranks from all the various industries, as well as those who have been throughout life debarred, by natural infirmities or other causes, from following any definite occupation. Another very serious flaw in these death-rates, when taken as measures of the relative healthiness of different industries, is due to the fact that these several industries do not start on equal terms as regards the vitality of those who follow them. A weakling will hardly adopt the trade of a blacksmith, a miner, or a railway navvy, but will preferentially take to some lighter occupation, such as that of a tailor, a weaver, or a shopman. This defect in the death-rate gives an unfair advantage to such industries as demand much strength or activity in those that follow them. Such industries are, in fact, carried on by a body of comparatively picked men, stronger in the beginning, and maintained at a high level by the continual drafting out of those whose strength falls below the mark."

3. *Relation of Parental Occupation to School Child's Life.*

Here it is important to guard against possible fallacy. As Dr. Ogle points out, the stronger men go to the laborious occupations, the weaker to the less laborious. When the stronger men fall out, they also must seek less laborious occupations. It will not, however, follow that the children born of those parents will be among the "weaklings." On the contrary, they will be hereditarily among the strong. They will, however, inevitably be affected by the environment they are born into. If the parent falls out of the race early in life, probably the worsened environment of the child will affect the school life. If, as more commonly happens, the older children are at the end of school life before the parents become inefficient, the effect of the degraded environment will be less striking. The more recently born children are more likely to suffer, and the younger they are the more do they suffer. In estimating, therefore, the effect of parental occupations on the pre-school or school life of

the children, it is not enough to ascertain the present occupation of the parent; it is advisable, wherever possible, to ascertain the parental history. Otherwise, wrong inferences as to "degeneration" may be drawn—evanescent degeneration due to individual environment being mistaken for inherited degeneration.

How important the study of occupational health is both in relation to the parent and in relation to the children is made obvious by a study of the dangerous trades. Dr Tatham remarks:—"The foregoing remarks, with respect to fluctuations in general mortality, may have little obvious bearing on the subject in hand, namely, the mortality of occupations. But I adduce them in order to assist in explaining what will be further emphasised later on, *i.e.*, the fact that even in the same industry the workers in various places experience wide differences in their mortality—differences which can only be accounted for on the theory that conditions of environment determine, to a greater degree than is usually believed, whether the mortality of a given industry shall be favourable or the reverse."—("Dangerous Trades." Edited by Thomas Oliver, M.A., M.D., F.R.C.P., p. 119.)

If the "conditions of environment" thus seriously affect the adult life, how much more must it, directly and indirectly, affect the life of the child, who suffers from every influence that impairs the efficiency of the parent!

4. *Children's Occupations—The Half-Timer.*

Legally, in Scotland, all children must attend school for the whole prescribed school time, except those that, having attained a certain standard, are entitled to become "half-timers."

In the industrial towns, the half-time system certainly affects both directly and indirectly the course of education. In every school, therefore, the medical inspector should make an exact record of the number of "half-timers," the length of time they work, the class of occupation they follow, the length of time they attend school, the effect of the combined school and industrial labour on

the time for meals, the time for open-air exercise, the time for sleeping, the effect on nutrition, on nervous system, and generally on the rate of educational progress. On purely physiological grounds, it is certain that many "half-timers" are considerably overloaded. The strain of intellectual effort at one end of the day is supplemented by the strain of labour at the other end. The play time is necessarily sacrificed. There is no real rest, no detachment from occupation either mental or physical; there is continually a serious concentration either on the school work or on the paid occupation. To this add that the economic necessity pressing the child thus to overfill his time loads him further with anxiety to do his duty, to make as much money as he can for his parents and himself, and generally to spend a greater store of energy on the day's routine than the ordinary school child does. Add, further, that the school work and the industrial work are usually disparate in character; that, accordingly, the one acts as a distraction to the other; that the industrial occupation is continually suggesting the time when freedom from all school work shall arrive; that the intelligence, instead of being directed strenuously to the acquisition of knowledge that in the boy's estimate does not pay, is continually directed to the methods of increasing the income. How deeply this desire to become economically independent divides the mind from school work can be appreciated best from the study of child occupations in towns. In the country, the non-school hours are more frequently given to play or voluntary unpaid occupations. In the towns, they are as readily given to occupations that pay, since paying occupations are vastly more numerous in the towns.

In the "half-timer," doubtless, the division of mind involved in the effort to combine intellectual discipline with routine occupation is shown in its most defined, if not in its worst, form. Physiologically, there is no defence for the system. Economically, there is occasional urgency as a preventive of greater evils. But concrete experience always suggests a doubt whether it be not

better to stop school education entirely than run the risk of exhausting the child's nervous system by the pretence of educating a mind housed in an overwrought body.

5. *Occupation before and after School Hours.*

The "half-timer," however, is not the only occupied school child. The whole-time child may add to his school work a paid occupation. Among the 600 children examined in Edinburgh, a considerable number were found to supplement their school work at both ends of the day. In the early morning, it was the duty of some to take their father's breakfast to the works, of others to act as errand boys, of others to distribute milk. In the evenings the same children acted as shop messengers for a part of every evening, or sold newspapers or matches in the street, or went out to attend neighbours' children. On Saturdays, they acted as message boys or message girls for the whole day, working sometimes as late as ten and eleven, and even twelve, at night. The same children doubtless would attend Sunday school. Thus, if their total output were reckoned in hours of labour, it would in many cases be found to reach, on the total, from ten to eleven or twelve hours a day. It is true that the temptations to these great exactions on growing children are mainly present in the towns. It is also true that some of the occupations followed are rather recreations and play than occupation. But it is also true that in many cases the occupations followed are nervously exhausting, always distracting, and at the best rather discouraging than encouraging to the work of school. No considerable body of statistics is immediately available to show how far the special occupational systems encroach on the school work; but that they do encroach to a very considerable extent is undoubted. Every medical inspection register should take account of the fact. The child that expends his energy both on school work and on paid occupation may acquire a more extended education, a more informed apprenticeship to life than the child that attends to school alone; but he does so at the risk of impairing his nutri-

tion, of foreshortening his growth, of hastening his maturity, of limiting his ultimate development, of lessening his ultimate physical efficiency.

6. *Statistical Illustrations.*

That these obvious deductions from physiological principle are not unwarranted the figures given in the chapter on Nutrition and Growth show. These are taken from extreme cases, the one set of children representing well-fed children at school, the other set representing children in the workshops and factories, and presumably less well-fed and more exhausted by occupation. These figures form no precise parallel to the "combination" child here referred to; but it is permissible to infer that the effects shown in the extreme cases indicated in the figures are, to a greater or less extent, produced in the "combination" child as well. It might even be maintained that the combination of a school day with morning and evening light occupations and a full day's occupation on Saturdays would be more dangerous to nutrition and growth than the exclusive devotion to occupation. Occupation, it is to be remembered, always demands such attention to feeding as will ensure continuous efficiency. It may be that the early occupations interfere with growth to the extent even of producing children of less weight and diminutive stature; but at least, if the system is to pay either parent or employer, the physique of the child must receive some attention. Too much, however, may be made of this argument. In the early days of English factories, the employment of children led to such gross scandals in the sacrifice of child-life that the progress of factory legislation was enormously hastened. So long as the supply of children was forthcoming, the sacrifice of their lives to the industrial system was a secondary matter. Although, therefore, under good conditions of industry, under stringent limitations stringently enforced, the conditions of child labour might be made such as not seriously to interfere with growth, we must still conclude that, on the whole, even in the best-regulated communi-

ties, the facts point the other way. It nevertheless remains that the combination of school labour with the occasional occupations already described may, if it does not produce the serious effects of either the early factory days or the more limited child-labour of to-day, yet seriously interferes both with education and with growth. On all grounds, therefore, it is of primary importance both educationally and industrially to have an exact record of the effects of occasional and constant occupation on the health of school children.

7. *Concrete Illustrations of Wage-Earning School Children.*

In a paper read at the Conference of Women Workers, at Edinburgh, in October, 1902, Miss Gertrude N. M. Ramsay gave some details as to the wage-earning children in Scotland. She states:—"I will give briefly their results, speaking mainly of the Edinburgh inquiry, as the facts there obtained were given to me, as a member of the Council, to analyse and report upon. Out of the thirty-two schools under the Board information was received from twenty-four. Full particulars of the children working for pay were obtained by the head-masters and teachers, and entered upon schedules furnished by us. Full details were received of one thousand four hundred and six cases, the number of employed children amounting to about 7 per cent. of the total number on the roll of those schools sending information. Nearly half of these children were employed in delivering milk or newspapers. The hours of work ran from one to three hours before school; some worked an hour or two after school also, and some during the mid-day meal hour. Many were at work by six, some before that. The total hours worked weekly by these children ran usually from 5.30 a.m. to 7 p.m. daily, except during school and meal hours, and six and a half hours on Sunday also. Leaving these two employments apart, nearly all the rest were employed in running messages for shops—grocers, bakers, butchers, &c.—and some of these were kept at work for

very long hours. Three hours after school was common, a number were working four and five hours. One boy was employed by a grocer from 8 to 9 a.m., and from 4 to 10 p.m.; on Saturdays from 8 a.m. to 10 p.m. This boy, though thirteen years old, was only in the third standard. Now, three or four hours' work daily, in addition to school work, makes a heavy day, but there is perhaps more hardship in the very long hours which many work on Saturdays. No less than two hundred and eighty-two children were returned as working twelve hours and more on the Saturday. Several were employed for a period of fifteen hours, one boy from 7 a.m. till midnight. Part of this time is, no doubt, spent in waiting about for messages—it may not mean a time of steady hard work; but however light the work may be, it is a very long period for young children to be kept on duty, and the late hours at night can be nothing but harmful. To speak of the longest hours, we found that two hundred and forty-two children were working thirty hours per week, or more; of these, twenty-five worked more than forty hours. I have given two instances, and may quote another:—A girl of nine was working for a grocer from 8 a.m. to 9 p.m. daily, except during school and meal hours; on Saturday from 7 a.m. to 11 p.m. The wages she received were two shillings per week. Three months afterwards I was informed that the child had had to be moved down from Standard II. to Standard I., and that subsequently, her health giving way, she had given up her employment.

"In Scotland, as in all parts of the United Kingdom, the police control children selling in the streets, under the Prevention of Cruelty to Children Act of 1894. This Act forbids street selling by children under eleven years of age, and prohibits boys under fourteen, and girls under sixteen, being so employed between nine at night and six in the morning. The law seems to be fairly well enforced. But there is a law older than this. Scotland has her own separate system of education, her own educational law. School Boards are universal. The Scottish Education Act

of 1878 provides that no child under ten may be employed at all, and that no children attending school may be employed after 7 p.m. in winter, or 9 p.m. in summer. The enforcement of the law is entrusted to the School Boards. The clause as to age limit was dropped in a revision of the law last year, but the law about the evening limit still holds good."

Probably the clause referred to is the following:—"It shall not be lawful for any person to take into his employment any child (1) who is under the age of twelve years, or (2) who, being of the age of twelve years and not more than fourteen years, has not obtained exemption from the obligation to attend school from the School Board of the district in the manner provided in the next following section; nor shall any child (1) who is under the age of twelve years, or (2) who, being of the age of twelve years and not more than fourteen years, has not been exempted from the obligation to attend the school in manner aforesaid, be employed in any casual employment, as defined by section six of the Education (Scotland) Act, 1878, after nine o'clock at night, from the first day of April to the first day of October, and after seven o'clock at night from the first day of October to the first day of April. Provided that nothing in this section shall prevent any employer from employing any child who is lawfully employed by him or by any other person at the date of the commencement of this Act."—(The Education (Scotland) Act, 1901.)

8. *Street Trading and the Day Industrial School.*

It is usually assumed that the children most affected by street trading or message occupations, or the like, are not only among the worst educated, but are also themselves the least intelligent. On the contrary, there is some evidence to prove that many of the most intelligent children of the State schools are also the most constant street traders, or are most persistently occupied in their non-school time. Probably this, if it be true, means that on the average the children of best brain are also the

children of greatest energy and the greatest inventiveness. They have a keener outlook on life, they have a readier faculty for seizing an occasion, they are, in fact, more efficient. It must, however, be allowed that the facts and tests are of the vaguest kind. As a general truth it may be taken that the quickest in school are also the quickest in non-school occupations.

To qualify this, we must remember another extreme case, namely, the type of boy and girl that has resulted in the formation of the day industrial school. The striking success of the day industrial school in Edinburgh rests upon the fact that it is specially adapted to the active, restless truant, who fails to find in the routine methods of the ordinary school the interests that shall satisfy his abounding energy and capacity for action. His truant instincts are the expression of organic tendencies that in their proper relationships may be of the highest social value; but they cannot always be guided into the channels provided by the ordinary school. The truant instinct is, after all, only the more vigorous revolt of the natural child against routine. It implies energy; it may become the basis of character, and, to the skilled manager of children, it frequently offers superb opportunities. It cannot be suppressed; it ought to be used. If the interests of the ordinary school do not meet the infinitely mutable and variable wants of the truant, he should have created for him a more varied environment. The creation of such an environment is the aim of the day industrial school. By associating the truant adventurer in a group of adventurers like himself, it at once meets his desire for revolt. By guiding his intelligence in practical channels, it encourages his desire for practice. By requiring his attendance at an early hour in the morning, it abstracts him fresh of mind and early in the day from the infinite distractions of his ordinary surroundings. By setting him free at a fixed hour in the evening to do as he pleases, it elevates freedom to the position of a reward for labour. More than all, it sees to his regular feeding, it insists on regular cleansing, it

provides occupations of interest to every growing boy and girl. It is, in a word, a special environment to suit the spontaneous variants that deviate too widely from the average type.

What is true of the day industrial is true in varying degrees of the ordinary industrial and the reformatory schools. The day industrial, however, has in some ways an advantage. It does not to the same extent "institutionalise" the child. In principle, it does what the ordinary school does—it applies to a special type the education most suited to it. It does more—it provides the food and the occupation necessary to make the character fit to profit by the education offered.

9. *Regulation of Street Trading.*

That the street trading of school children has grown into a serious problem is further shown by the legislative movements to regulate it. In the Liverpool Corporation Act, 1898, the local authority obtained very extended powers for regulating the street trading of children. The sub-committee appointed in 1900 to investigate the working of the Act, and the bye-laws framed under it, reported that the administration had been partially successful in reducing the amount of street trading. An extension of powers was recommended. The Bill introduced and passed in the Parliamentary session of 1903 followed the main lines of the Liverpool Act. As indicating the scope of the measure, we quote a few leading provisions:—

"*Power to make Bye-Laws for Regulating the Employment of Children.*

"1. Any local authority shall make bye-laws—

(1) Prescribing for all children, or for boys and girls separately, and with respect to all occupations or to any specified occupation—

(*a*) The age below which employment is illegal; and

(*b*) The hours between which employment is illegal; and

(*c*) The number of daily and weekly hours beyond which employment is illegal—

(2) Prohibiting absolutely or permitting, subject to conditions, the employment of children in any specified occupation.

"*Power to make Bye-Laws for the Regulation of Street Trading by Persons under Sixteen.*

"2. Any local authority may make bye-laws with respect to street trading by persons under the age of sixteen, and may by such bye-laws—

(*a*) Prohibit such street trading except subject to such conditions as to age, sex, or otherwise, as may be specified in the bye-law, or subject to the holding of a licence to trade, to be granted by the local authority;

(*b*) Regulate the conditions on which such licences may be granted, suspended, and revoked;

(*c*) Determine the days and hours during which, and the places at which, such street trading may be carried on;

(*d*) Require such street traders to wear badges;

(*e*) Regulate generally the condition of such street traders; provided as follows:—

(1) The grant of a licence or the right to trade shall not be made subject to any conditions having reference to the poverty or general bad character of the person applying for a licence or claiming to trade;

(2) The local authority, in making bye-laws under this section, shall have special regard to the desirability of preventing the employment of girls under sixteen in streets or public places.

"*General Restrictions on Employment of Children.*

"3. (1) A child shall not be employed between the hours of nine in the evening and six in the

morning; provided that any local authority may, by bye-law, vary these hours either generally or for any specified occupation.

(2) A child under the age of eleven years shall not be employed in street trading.

(3) No child who is employed half-time under the Factory and Workshop Act, 1901, shall be employed in any other occupation.

(4) A child shall not be employed to lift, carry, or move anything so heavy as to be likely to cause injury to the child.

(5) A child shall not be employed in any occupation likely to be injurious to his life, limb, health, or education, regard being had to his physical condition.

(6) If the local authority send to the employer of any child a certificate signed by a registered medical practitioner that the lifting, carrying, or moving of any specified occupation is likely to cause injury to the child, or that any specified occupation is likely to be injurious to the life, limb, health, or education of the child, the certificate shall be admissible as evidence in any subsequent proceedings against the employer in respect of the employment of the child."

In sections 1 and 3, the term "local authority" means the School Board. In section 2, it means the Town Council, if town is over 7000; elsewhere, it means County Council.—(Employment of Children Act, 1903.)

10. *Half-Time Schools.*

The general considerations already advanced on the problem of the "half-timer" may be criticised in the light of the evidence obtained by the Royal Commission. In the evidence of Miss Mary Anderson, of the Ferguslie Half-Time School, and Mr. Strachan, of the Dundee Half-Time School, an argument supported by some facts is advanced to show that in many respects the "half-timer"

has a distinct advantage over the whole-time scholar. That a certain degree of proficiency in school studies may be combined with labour goes without saying, but the goodness of the combination will depend primarily on the nature and amount of the labour.

From evidence of Miss Mary Anderson, Ferguslie Half-Time School, Paisley, examined by Sir Thomas Glen Coats:—

You give certain reasons why children attending school every alternate day are as far up as the children in the Board schools? —Yes.

I bring forward the following reasons as to why the scholars in above school are able to obtain as good results at their annual inspection as those in the Board schools, where the attendance is double:—

(1) The school has always been exceedingly well staffed, no pupil teachers nor ex-pupil teachers, but certificated Normal-trained teachers having been employed.

(2) The classes are smaller than in the Board schools, and thus the teachers get at the scholars individually, and gain a more personal influence over them than when grouped in larger classes.

(3) Being in close alliance with the mill, it has always been an easy matter to gain excellent discipline, which is a great aid in securing excellence in all school work.

(4) The school itself and its environments are so particularly bright and beautiful that their effect cannot but be good. The mind as well as the body is bound to be healthier, with fresh air, good light, and bright surroundings.

Then again as to the effect on the health of the girls while working half-time and afterwards, I must say, as far as my experience goes (and I have been in the school since its opening in 1887, and have enrolled 3335 scholars), that the girls here are as healthy and attend as regularly as those in any school in town, while they develop into quite as strong women as do those who begin work at fourteen years of age or over it.

I have had many talks with my old pupils, who never seem to regret the years spent in half-time, but rather look back

with pleasure to that period of their lives when they worked in the mill and attended school each alternate day. (Q. 13,207.)

* * * * * * *

Do you consider that the children in your school have obtained as good an education as those children who are attending every day?—The inspectors seem to think so.

* * * * * * *

Are your pupils strong and healthy?—The attendance is really better with us than with the other schools, so that I would imagine that their health should be quite as good, if not better. Some of the girls develop greatly, but whether it is due to better food and the class-rooms being so particularly healthy and not overcrowded, I don't know.

Is there any medical inspection?—No, except when they are admitted into the mill and passed by the doctors in the mill. I think, however, there should be medical inspection in all schools for defective eyesight, hearing, and skin troubles, which sometimes occur, and which are infectious. The doctor would notice what might escape attention otherwise. (Questions 13,223, 13,270, 13,271.)

From evidence of Mr. Andrew Strachan, Dens Works School (Half-Time), Dundee, examined by Lord Mansfield:—

The children when they are first employed are examined and passed by the certifying surgeon, but they are not examined periodically.

* * * * * * *

By Sir Thomas Glen Coats—You say that the proportion is larger with the girls than with the boys; how much larger?—For year ending 30th September, 1901, the average attendance of boys was 80·3, and of girls 107·6.

I understand you to say that during the time the girls were in school they would have no less education than the full-time scholars?—Yes, we bring them on one standard a year.

And by the time they leave they are as well educated as those who attend the full time?—I think so.

Don't you consider that rather a strange state of matters; in that case you would say that half the time they devoted to teaching the scholars in the other schools is thrown away?—I have this authority (the inspectors' reports), and I remember

Mr. Peter Carmichael sent me the Transactions of the Royal Society, and there was an article in them by Dr. Richardson, and he maintained that two and a half or three hours was all the brain work that a child could profitably be given per day, and if that is the case I think that the half-time school gives the time required. It does not fatigue the brain, and if they are average children they can go on a standard without any home lessons at all.

The system in your school is that children attend the school half the day and work the other half?—Yes.

Do you think that better than the alternative system?—Yes, a little every day is better than a big dose every second day.—(Rep. R.C.P.T.S., Questions 11,900 and 11,958-11,963.)

Here there is a danger of proving too much. If the adult brain can achieve good results only by concentration of attention—and we know that this is so—it is still more true that the growing brain requires concentration to achieve anything at all. The basis offered to justify the conclusions is far from adequate. It may very well happen that, in particular schools, the children selected for particular occupations may have the energy and the capacity adequate both to the labour and to the education demanded; but except so far as the labour is itself educative, the result is necessarily a dissociation of attention. It seems clear that the whole question of the relation between education as such and labour as such is too complex to be decided on any but the most extended evidence. The facts we have given, and shall give later, are not met by the facts adduced in the Royal Commission's evidence.

From evidence of Mr. John Taylor, M.A., Camphill Public School, Paisley, examined by Sir Thomas Glen Coats:—

You know something about the half-time school?—Yes.

These children do very well in half the time?—Yes, but they are the pick of our children.

Do you think so?—Yes, I think they are.

Of course they are kept at school regularly during the time they are there?—There is this very important fact, that the

children know that their work is noticed and that they are examined every month from headquarters; that makes them far more diligent than either their father or mother can make them. They know that if they stand well in their examinations they will stand well with the factory authorities.

That shows that some more time could be devoted to physical training?—In the half-time school there are a great many things not taught which we have to teach.

Why have you to teach them?—Because the Board exacts them from us.—(Rep. R.C.P.T.S., Questions 11,547-11,552.)

In his evidence on the Swiss schools, Mr. A. J. Pressland has the following:—"Children below fourteen years of age may not be employed in factories. From fourteen to sixteen years of age the total week's work for such children (school, factory, and religious services included) shall not exceed eleven hours a day. No person under eighteen years of age may be employed on night work." These are the restrictions considered advisable in a community where education is looked upon as of primary industrial importance.

But what applies to the "half-timer," even if we grant all the contentions in his favour, does not apply *simpliciter* to the child that works and yet continues to attend whole-time at school. The "half-timer" is always more or less a picked child. If he is not fit for the factory he does not become a "half-timer," and the factory is guarded by a medical examination. The severities of factory discipline also count for something. But the worker, before and after whole-time school hours, is practically left to his own discretion. He is not medically examined. He is under no time rules. He has no prospect of promotion according to diligence. In all these respects, he is in a worse position than the "half-timer." But even the attractive picture of the "half-timer," who is alleged to be as proficient all round, mentally and physically, as the whole-time pupil, shows certain shadows. It is admitted that the social condition of Dundee, where the strongest claims are made for the "half-timer," are not above criticism. It would carry

us too far to discuss here the observations and counter-observations. The interested student will study the public health reports and the counter-evidence laid before the Commission. The only logical issue of the evidence by the two half-time school teachers would be—If you wish to accelerate the education of children, reduce the school time to half, and for the other half set the children to work in the mills. On the evidence offered, we cannot accept this conclusion.

11. *Conclusion.*

It is not, however, our purpose to argue for or against the "half-timer." We are concerned merely to show the relation of occupation to the school life. The facts indicated make it impossible to doubt that the employment of children before and after school hours may be in particular localities a serious factor both in their education and in their health. Accordingly, as we have shown on other grounds, the inquiry into occupation is a proper part of a medical inspector's duty.

CHAPTER VII.

The Effects of Food.

1. *Selection by Food.*

Of the three selective agencies—housing, occupation, and feeding—unquestionably the most important is feeding. Indeed, the special selective effects of housing and occupation depend mainly on feeding. The three are too intimately associated to be separated, except for the purposes of analysis. But, unlike housing and occupation, feeding is limited to a perfectly ascertained range. Whatever be the condition of the housing or the occupation, the food must not fall below a defined quantity of defined ingredients. If a correct diet is habitually insufficient in quantity, the nutrition is more or less arrested; if an incorrect diet is more than sufficient in quantity, the nutrition is perverted. In the one case, starvation results, with the diseases following on it; in the other case, special nutritional diseases result—scurvy, rickets, anæmia, purpura, &c. And by correct diet we mean a diet where the proportion of tissue-forming and heat-forming elements are in the proportions necessary both to satisfy immediate physiological conditions and to preserve physiological equilibrium in the growing organism. These proportions have been ascertained by experiment and observation. The science of diet is sufficiently elaborated to permit of precise quantitative prescriptions—maximal and minimal.

To educate under-fed children is to promote deterioration of physique by exhausting the nervous system. Education of the under-fed is a positive evil. Education is not an act, it is a process, and it pre-supposes an organism varying within certain physiological limits. And the limits are primarily determined by the food. Between the well-fed child and the ill-fed child there is a difference not only in physical condition, but also in educable capacity. The physical condition may be ascertained by

simple inspection, by detailed medical examination of the physiological systems, and by measurement of height and weight in relation to age. The educable capacity is much more difficult to determine. But simple inspection here, too, affords some evidence. The differences in alertness and carriage, to name but these, between the well-fed and the ill-fed are frequently unmistakable. But any inference as to the effects due to insufficient or incorrect feeding must be grounded not in the observation of a single condition, but in the correlation of health appearance with the health of the physiological systems, and with the height, weight, and age.

2. *Illustration of Food Effects.*

In any individual case it may be difficult to decide how much of the starved appearance is legitimately attributable to food. But that some difference is always discoverable admits of no doubt. The striking contrasts between the children of the ill-fed and the children of the well-fed are conclusive. One illustration of this contrast is given in the sections already quoted (p. 167) from the Edinburgh Report. Other illustrations are given in the chapter on Nutrition and Growth.

3. *Illustration from Industrial and Reformatory Schools.*

The industrial school and reformatory children are mainly drawn from the same classes as the children of the poorer schools. For practical purposes they are the same children. The essential difference between the industrial school children and the non-industrial is due to difference in feeding. In those institutions, the dietaries are constructed on scientific principles. The quantities of food are sufficient. The proportions are suited to growing organisms. The meals are regularly given. The whole activities are more or less systematically adjusted to undo the effects of insufficient, incorrect, and irregular feeding. Accordingly, the contrast and comparison of children from the industrial schools and children from an ordinary day school are likely to be fruitful. Such a comparison

is made possible by the facts supplied in the Royal Commission's Report.

4. *Comparison of Reformatory and Industrial School Children with Edinburgh School Children of approximately same social grade.*

The contrast between the children of North Canongate School and the children of Bruntsfield School (see p. 167) is so striking that one naturally looks for confirmation of it elsewhere. One such confirmation is offered by the figures printed in Appendix I. of the Commission's Report—the figures provided by Mr. J. G. Legge, H.M. Inspector of reformatory and industrial schools. The children there reported upon appear to be of much the same class as the Canongate children. Two sets of measurements are summarised—one set made in 1883, the other in 1901. The boys and girls chosen were of ages eleven and fourteen.

"The schools responded readily to the invitation to furnish statistics, and the following tables show how, for boys and girls in industrial schools, the results obtained in 1901 compare with those published in 1883. The conditions of measurement have been the same. The height was taken without boots, the weight in clothes (but without boots—a heavy item in many schools), and the chest girth with the chest empty. The figures given in all the tables, both for reformatory and industrial schools, are *averages*:—

COMPARATIVE TABLE OF BOYS AND GIRLS IN INDUSTRIAL SCHOOLS IN 1883. (Table XXI. in Committee's Report.*)

Age last birthday.	Height in inches. Boys.	Height in inches. Girls.	Weight in pounds. Boys.	Weight in pounds. Girls.	Chest girth. Boys.	Chest girth. Girls.
14	54·46	55·00	77·35	81·25	27·29	...
11	49·11†	51·48	63·19	60·96	24·17	...

* *See* Appendix VII.

† This figure is probably too low. It is raised by Mr. Roberts in his paper of 1895 to 49·6. In Table XIII. of the Anthropometric Committee's Report the average height at eleven of industrial school boys is given at 50·02, but this figure probably related to a single school. It is also probable that Poor Law schools contributed to the Committee's figures.

COMPARATIVE TABLE OF BOYS AND GIRLS IN INDUSTRIAL SCHOOLS IN 1901.

Age last birthday.	Height in inches. Boys.	Height in inches. Girls.	Weight in pounds. Boys.	Weight in pounds. Girls.	Chest girth. Boys.	Chest girth. Girls.
14	55·50	56·74	80·63	88·43	28·08	...
11	50·82	51·40	64·63	65·0	26·02	...

Note.—The numbers of observations were much greater in 1901 than in 1883. In that year the numbers were, for all purposes, boys and girls of eleven, 158 and 63 respectively; boys and girls of fourteen, 102 and 33 respectively. In 1901 the numbers were, as regards height, at eleven, 1312 boys, 481 girls; at fourteen, 2367 boys, 765 girls; as regards weight, at eleven, 1296 boys, 384 girls; at fourteen, 2340 boys, 643 girls; and as regards chest girth, at eleven, 1312 boys; at fourteen, 2366 boys.

Let us compare these children with Canongate children of the same age.

(*a*) *Height.*—While, in 1883, industrial boys of eleven yielded an average height of 49·11, or more correctly, 49·6, Canongate children of eleven yielded an average height of 50·76 inches. There is a difference of 1·1 inch in favour of Canongate.

While industrial girls yielded a height of 51·48 inches, Canongate girls yielded 52·07 inches—·5 inch in favour of Canongate.

Industrial boys of fourteen gave 54·46 inches; Canongate boys, 55·85—difference in favour of Canongate, 1·4 inch.

Industrial girls of fourteen gave 55 inches; for Canongate girls no figure is available, but Canongate girls of thirteen gave 57·04 inches—difference of 2 inches in favour of Canongate.

To take the corresponding figures of 1901, industrial boys of eleven gave 50·82 inches, as against Canongate, 50·76. Industrial girls of eleven, 51·4, as against Canongate, 52·07.

Industrial boys of fourteen gave 55·5, as against Canongate, 55·8. Industrial girls of fourteen gave 56·74 as against Canongate (girls of thirteen), 57·04.

Thus in height, Canongate has, on the whole, the advantage.

(*b*) *Weight.*—In 1883, industrial boys of eleven weighed 63·19 pounds, as against Canongate, 62·88.

Industrial boys of fourteen weighed 77·35, as against Canongate, 74·5, this figure, however, being the average of only two children. In 1901 the weights were :—Industrial boys of eleven, 64·63 lbs.; Canongate, 62·88; industrial boys of fourteen, 80·6, as against Canongate, 74·5.

Industrial girls of eleven (in 1883) weighed 60·96 lbs., and in 1901, 65 lbs., as against Canongate, 62·69 lbs. Industrial girls of fourteen, in 1883, weighed 81·25 lbs., and in 1901, 88·43 lbs., as against Canongate, for girls of thirteen, 80·63 (no figures being available for girls of fourteen).

It is thus seen that, while the height of Canongate children is rather more than the height of industrial children, the weight is appreciably less. The numbers at the special ages in Canongate School were, however, too small to afford a proper comparison. But if the figures should be confirmed by a more extended series of measurements, it would be legitimate to infer that the preponderance of the industrial children in weight was due to the more systematic nurture made possible by the institution. It has to be remembered that "the great majority of the children come from the slums of towns" to the industrial schools, and that on the average they are probably more ill-nourished than those likely to be found in any State school. This renders it all the more probable that the improvement in nurture is the primary cause of the preponderance in weight. This is confirmed by the other observations of the Canongate children.

This comparison is made somewhat more close by the figures given in a comparative table on English and Scotch children in reformatory schools. The children of reformatory schools, however, are normally of a more vigorous type than the children of the industrial schools.

"Here, again, the balance between the two countries is fairly even. As regards boys Scotland has the advantage at fourteen, England at seventeen. The smallness of the number of observations in the case of Scottish girls rather spoils the comparative value of the second table."

Comparative Tables of Inmates of English and Scottish Reformatory Schools.

Boys.

Age last birthday.	Height in inches. English.	Height in inches. Scottish.	Weight in pounds. English.	Weight in pounds. Scottish.	Chest girth in inches. English.	Chest girth in inches. Scottish.
17	61·70	60·46	110·41	107·31	31·81	31·59
14	56·22	56·35	84·24	84·90	28·17	28·58

Girls.

Age last birthday.	Height in inches. English.	Height in inches. Scottish.	Weight in pounds. English.	Weight in pounds. Scottish.
17	60·70	61·58	111·83	111·00
14	58·11	57·69	95·65	96·86

Note.—The numbers of observations were—England, at age fourteen, height, 677 boys and 95 girls; weight, 677 boys and 92 girls; chest girth, 677 boys; at age seventeen, height, 520 boys and 136 girls; weight, 520 boys and 117 girls; chest girth, 520 boys. Scotland, at age fourteen, height, 142 boys and 18 girls; weight, 142 boys and 7 girls; chest girth, 142 boys; at age seventeen, height, 50 boys and 13 girls; weight, 50 boys and 2 girls; chest girth, 50 boys.

These tables afford materials for comparison with those given in this and the following chapter.

5. *Deliverance of the Royal Commission.*

The Commission has fully recognised the importance of food as a condition both of the general education of the child and of his physical training. Many of the witnesses emphasised the necessity for correlating food and exercise. With the special recommendations for securing that no ill-nourished children shall suffer from mental or physical education we are not immediately concerned. It is enough here to say that feeding is of such overwhelming importance that the effects of inadequate or incorrect feeding must be regarded as among the primary inquiries of the medical inspector.

In the Report occur these sentences:—"We consider that the question of the proper and sufficient feeding of children is one which has the closest possible connection with any scheme which may be adopted for their physical, and equally for their mental, work. It is evident that among the causes which tell against the physical welfare of the population, the lack of proper nourishment is one

of the most serious. The subject demands special notice, not only as regards the existing state of affairs, but still more in view of any increase of physical training throughout the State-aided schools which may commend itself.

"We are aware of the danger of further encroaching upon the independence of parents, and of entering upon the wide question of how far the State should go in relieving them of their primary responsibility. But we are not on that account deterred from calling attention to the necessity for better feeding, which, in our opinion, has been fully demonstrated, nor from considering a practical remedy. We have no desire to give encouragement to any inclination of the parent to abandon any of his duties and responsibilities in regard to the feeding and clothing of his children; but it must be remembered that, with every desire to act up to their parental responsibility, and while quite ready to contribute in proportion to their power, there are often impediments in the way of the home provision of suitable food by the parents. The proper selection, cooking, and preparation may often be matter of serious difficulty to many parents. It would be in many cases an inestimable advantage could regular and sufficient meals—such as broth, porridge and milk, or bread and milk—be provided at a minimum cost. The preparation and cooking of these meals, where it is found necessary to provide them, ought to be regarded as one of the charges incident to school management.

"In like manner we think that an obligation for the proper supervision of the feeding of those who come for instruction should be regarded as one of the duties of school authorities, and that teachers should be instructed to take note of all children apparently ill-fed. Unless children receive sufficient nourishment, they cannot be expected to profit by the mental or physical training provided for them."

6. *Conclusion.*

These deliverances confirm our view that the effects of food are among the first things to demand the scrutiny of

the medical inspector. He will assist in improving the knowledge of correct feeding, and in directing attention to inadequate feeding. He will be able to increase the occasions for the profitable activity of organised charity. He will accumulate materials for the practical improvement of diet. He is not primarily concerned with administrative measures; but his observations of the effects of under-feeding will tend to keep the administrative mind on the outlook for remedies. And this is the first step.

CHAPTER VIII.

Nutrition and Growth as shown by Height and Weight.

1. *Fundamental Importance of Height and Weight.*

Height and weight are of fundamental importance in the medical inspection of schools. Is the child as tall as he ought to be for his age? Is he as heavy as he ought to be for his height? These questions which, for adults, are of primary value in every service, are indispensable above all things in the inspection of school children. For the ends of military service the height and weight of recruits are as essential as an estimate of fitness for definite work. The height and weight of school children are equally essential for an estimate of fitness for school work. But between the measurement of adults and the measurement of children there is a cardinal difference. The height and weight of adults are primarily an index of nutrition; the height and weight of children are primarily an index of growth. It is important, therefore, to consider height and weight in some detail.

2. *General Problem of Growth.*

"Growth is the total of internal phenomena by which the new-born child increases in size, that is to say, in weight, in volume, and in length. Growth is mainly a matter of hypertrophy, that is, an increase in three dimensions of the cellular elements that constitute the organism; and it is the hypertrophy of these elements that causes the hypertrophy of the organism. The period of growth varies according to the subject; here, it is a few weeks; there, a few years, perhaps even a century."—(Richet: "Dictionnaire de Physiologie," art. *Croissance.*)

But the tissues constituting the body do not grow at a uniform rate. The organs do not mature all at the same time. The hard tissues—bone and cartilage—grow in size at a different rate from the soft tissues. A period comes both in bony and in soft tissues when growth entirely ceases; but the period of cessation also varies.

Among the growing tissues, however, the bones, as the framework of the body, are easily distinguished and easily measured. The point, too, when they cease growing in length can be precisely ascertained. Consequently, as the length of the body practically depends on the length of the bony framework, or skeleton, and as the rate of growth in bone is relatively slow, the skeleton becomes a convenient measure for correlating the growths of the soft tissues. The measurement of height is really the measurement of the length of the skeleton. As the skeleton does not alter in dimensions so readily as the other tissues, it forms a relatively stationary standard.

3. *Height and Weight in relation to Growth.*

At birth, a child of average parents approximates to a certain standard of height and weight. As the tables given below indicate, he advances rapidly in growth. It is found when averages of large numbers are taken that the rate of growth may be definitely gauged by the rate of increase in height and weight. Before the child comes to school, he has already passed through five years of life. He will, therefore, have attained to a certain height and weight; but the absolute measurement of these gives no answer to the question—Is he as tall as he ought to be, or as heavy? The answer to that question involves several factors. To begin with, the child being born of parents belonging to a given race, is physiologically capable of attaining to a certain stature, beyond which growth will cease. This fundamental pre-determination governs his growth through childhood. His growth may vary in speed; he may be a child of small parents; he may, therefore, though himself small, be fully grown for his age. In order that a standard may be obtained, it is necessary

to take averages over vast numbers of children at each year of age. Nor this only. The numbers must be sufficient to eliminate variations due to race, to heredity, to climate, to food, to occupation, to social differences, to disease. Growth is affected directly or indirectly by each of these. Accordingly, the estimate of height and weight for the determination of growth must take account of each of these factors.

4. *The relation of Growth to Nutrition.*

Growth is in some way and in some degree influenced by nutrition, that is, by the food and air supply of the organism. It is a question for evidence whether a child badly nourished in the early years of life ever attains to the same stature as it would have attained to had its nourishment been sufficient. Some have maintained that early starvation does not ultimately affect growth, provided the food is sufficient in the later growing years. Others, on the contrary, maintain that where nutrition in early life is bad, the full stature is never attained. It is certain that, whatever be the effect of nutrition on the ultimate limit of growth, the rate of growth varies according as nutrition is sufficient or insufficient.

"Influence of Nutrition on Growth.—There has been much discussion on the influence that nutrition, or alimentation, or the social condition, may have. As far back as 1829, Villermé declared that the stature is higher and growth more active in the communities that are richer, better nourished, and better protected against inclement weather. Quetelet gave out the same opinion, and the majority of those that have studied the question come to the same conclusion; for example, Cowell (1883), who has compared the statistics of 1062 factory children and of 228 children of the leisured classes; Bowditch also, but with him the defective conditions of existence act more on the height than on the weight, and this is seen in the fact that children of the working-classes are heavier, height for height, than children of the leisured classes; these latter being absolutely taller and heavier. On the other hand, opinions diverge; Boudin does not quite believe in the influence of

nutritional conditions, and maintains that there is a considerable race effect; Donaldson admits certain action, but maintains that this affects the male sex more than the female. Porter admits that a considerable difference in social condition and in material prosperity may exist without much influence on growth up to the acceleration that precedes puberty. Key says that want prolongs the period of feeble growth anterior to puberty, and that the period of rapid development consequently supervenes at a later epoch. . . . On the whole, there would be a delay in time; but the final condition would not be altered. Roberts comes to a different conclusion—from the establishment of puberty, growth is more active in the non-working-classes, ceasing at nineteen or twenty years of age; in the artizan class, growth is more uniform and continues up to twenty-three years or thereby. Still he points out a fact analogous to that spoken of by Key. For him, the growth that precedes puberty begins a year or two earlier in the leisured class, and in these the average stature is greater. The Anthropometrical Committee of England admits also that the leisured classes are, at every age, taller and heavier than the working-classes. Gussler and Uhlitch have compared the children of the Burgherschale of Fribourg with those of the inhabitants of the surroundings, and they have found that in stature at the same age the former exceed the latter. The figures following indicate the excess in size of the pupils of the Burgherschale over the children of both sexes of peasants (in centimetres) :—

Age, -	$6\frac{1}{2}$	7	8	9	10	11	12	13
Boys, -	2·4	2·7	2·3	5·1	2·7	2·3	3·8	4·7
Girls, -	3·9	3·6	2·8	3·8	4·5	3·9	3·1	5·1

"Hence the conclusion that 'the children of the peasant *females* are, on the average, and without exception, smaller; the children of the Burgherschale are greater than the average of the whole. It seems, then, permissible to conclude that the different social conditions in which the children live exercise an essential influence on their physical development.'

"Gciesler reaches analogous results; also Hertel and Erismann. Erismann compares the children of the schools in Moscow with the children of the workshops and factories, and the following figures indicate, at the different ages, the excess in stature of the school children (boys) :—

Age, -	9	10	11	12	13	14	15	16	17
Excess, -	0·4	4·6	5·7	5·7	7·7	9·0	9·7	8·7	5·4

"It is seen that the excess reaches a maximum at fifteen years and diminishes rapidly thereafter; this confirms the views of Roberts.

"Key, comparing the children of middle-class schools (des écoles aisées) in Stockholm with those of the poor schools, notes that the former are at once taller and heavier (with one exception indicated by the sign *minus*). The figures indicate in centimetres and kilogrammes the excess of the children of the leisured classes both in height and weight.

HEIGHT.

Age,	7	8	9	10	11	12	13	14	15
Boys,	4	4	6	4	2	3	2	5	4
Girls,	−1	2	2	2	3	3	2	2	3

WEIGHT.

Boys,	0·3	0·4	3·0	1·6	1·6	1·5	1·6	5·3	...
Girls,	−0·6	1·8	1·4	0·4	1·4	2·0	1·9	3·5	2·9

"Pagliani states that the girls of the leisured classes are taller and heavier than the girls of the charity schools. In a general way, then, it appears that, during infancy, development is less considerable among the poor than among the leisured classes, this being so where the statistics really concern individuals among whom the differences are simply differences of fortune, not differences of race."—(Translated from Richet: "Dict. de Phys.," art. *Croissance*.)

Certain experiments have been made to determine the effect of specific foodstuffs on the rate of growth. But the results have been inconclusive. "It does seem, however, that, in a general way, abundant and appropriate feeding (Bouchard has insisted on the necessity for fats, sugars, starch, phosphoric acid, lime, as they exist in milk, eggs, haricots, peas, lentils, bread, &c.) favours growth; but this is all that can be said in the present state of the question."—(*Op. cit.*, art. *Croissance*.)

It is instructive to compare these figures with the figures emerging from the examination of the Edinburgh school children. The leading difference between the children of North Canongate School and the children of Bruntsfield School was a difference in nutrition. The contrast between North Canongate and the other two

schools was not so striking, but it exhibited much the same relationship. (For comparison between North Canongate and Bruntsfield see p. 167.)

"In comparison of the other schools with each other, the differences are less striking, but still considerable. Thus, to take the four schools in the following order—(1) South Bridge, (2) London Street, (3) North Canongate, (4) Bruntsfield—the figures for weight are these:—

Males.

Age.	(1)	(2)	(3)	(4)	Average.
6 to 9	46·1	47·6	43·85	49·23	46·60
9 to 12	60·43	58·60	56·49	62·49	59·53
12 to 15	74·45	75·60	70·38	75·6	74·02

Females.

Age.	(1)	(2)	(3)	(4)	Average.
6 to 9	45·49	45·92	40·45	50·63	45·62
9 to 12	56·86	59·27	55·91	58·99	57·76
12 to 15	74·87	80·91	72·63	85·01	78·36

In weight, North Canongate is lowest in every age-group, male and female.

The corresponding figures for height are these:—

Males.

Age.	(1)	(2)	(3)	(4)	Average.
6 to 9	44·47	45·10	42·93	45·58	44·52
9 to 12	50·36	50·01	48·54	51·87	50·20
12 to 15	55·09	55·77	54·31	55·87	55·26

Females.

Age.	(1)	(2)	(3)	(4)	Average.
6 to 9	44·06	44·83	42·98	46·8	44·51
9 to 12	49·42	49·91	49·11	51·28	49·93
12 to 15	54·93	55·61	54·71	57·36	55·65

In height, as in weight, North Canongate is lowest.

"*Comparison of Weights.*—For males of ages six to nine, South Bridge and North Canongate are below the average of the four schools—South Bridge being 0·5 lb. less, North Canongate 2·75 lbs. less. London Street and Bruntsfield are respectively 1 lb. and 2·63 lbs. above the average.

"For females of six to nine, South Bridge and Canongate are, respectively, 0·13 lb. and 5·17 lbs. below the

average. London Street and Bruntsfield are, respectively, 0·3 lb. and 5 lbs. above the average.

"For males of nine to twelve, London Street and North Canongate are, respectively, 0·93 lb. and 2·04 lbs. below the average. South Bridge and Bruntsfield are, respectively, 0·90 lb. and 2·96 lbs. above the average.

"For females of nine to twelve, South Bridge and North Canongate are, respectively, 0·9 lb. and 1·85 lb. below the average. London Street and Bruntsfield are, respectively, 1·51 lb. and 1·23 lb. above the average.

"For males of twelve to fifteen, North Canongate is 3·64 lbs. below the average. The other three—South Bridge, London Street, and Bruntsfield—are, respectively, 0·43 lb., 1·58 lb., and 1·58 lb. above the average.

"For females of twelve to fifteen, South Bridge and North Canongate are, respectively, 3·49 lbs. and 5·73 lbs. below the average. London Street and Bruntsfield are, respectively, 2·55 lbs. and 6·65 lbs. above the average.

"Thus for every age-group, male and female, North Canongate stands lowest in weight and Bruntsfield highest.

"*Comparison of Heights.*—For males of six to nine, South Bridge and North Canongate are, respectively, 0·05 in. and 1·59 in. below the average. London Street and Bruntsfield are, respectively, 0·58 in. and 1·06 in. above the average.

"For females of six to nine, South Bridge and North Canongate are, respectively, 0·45 in. and 1·53 in. below the average. London Street and Bruntsfield are, respectively, 0·32 in. and 2·29 in. above the average.

"For males of nine to twelve, London Street and North Canongate are, respectively, 0·19 in. and 1·66 in. below the average. South Bridge and Bruntsfield are, respectively, 0·16 in. and 1·67 in. above the average.

"For females of nine to twelve, South Bridge, London Street, and North Canongate are, respectively, 0·51 in., 0·02 in., and 0·82 in. below the average. Bruntsfield is 1·35 in. above the average.

"For females of twelve to fifteen, South Bridge,

London Street, and North Canongate are, respectively, 0·72 in., 0·04 in., and 0·94 in. below the average. Bruntsfield is 1·71 ins. above the average.

"For females of twelve to fifteen, South Bridge and North Canongate are, respectively, 0·72 in. and 0·94 in. below the average. London Street and Bruntsfield are, respectively, 0·04 and 2·29 ins. above the average.

"Thus in height, as in weight, North Canongate is uniformly lowest, Bruntsfield is uniformly highest.

"On other grounds, North Canongate is shown to be the worst nourished and Bruntsfield the best. The detailed comparison of weights and heights gives to the general impression an absolute confirmation.

"*Comparison of Averages at each Age with General Averages.*—In a special table (Vb.) I have shown the average weights and heights (males and females) for each of the four schools, side by side with the averages of the Anthropometric Committee's Report of 1883. (See Stevenson and Murphy's 'Hygiene'; Treves on 'Physical Education,' p. 544.)

"In general, the averages both for weight and height are below the Anthropometric Committee's standards. Bruntsfield School comes best out of the comparison. It is to be noted, however, that in the Anthropometric Committee's tables 'weights' include the weight of shoes; in the Edinburgh and Aberdeen tables shoes are excluded. Even if an allowance of three-fourths of a pound at the lower ages to two pounds at the higher be made, the relations of weights recorded are not very greatly disturbed."

5. *Factors in Growth.*

Factors in growth may be classified into two—Nature factors and Nurture factors.

Under Nature factors we include heredity and race (see chap. II.). Under Nurture factors we include food, housing, cleanliness, and all other environmental conditions.

Growth depends primarily on race and nurture. Nurture means, in substance, feeding, housing, and clothing. The full explanation of given heights and given weights thus involves the whole racial and social conditions that the child springs from. It is impossible that a medical inspector of schools should inquire into all these problems; but it is satisfactory that the measure of height and weight affords an exact basis of comparison without the necessity for descriptive detail.

The practical value of the induction that growth depends in some degree on nutrition lies in this:—Where growth has proceeded so slowly that the height and the weight are below the average, it is legitimate, on this ground alone, to inquire whether the nutrition has been adequate. It is not enough to say—"This child is of a given height; therefore, since his weight is great enough in proportion, he has been well nourished." It is essential to ascertain whether the height and weight are, considered in correlation, above or below the average for the given age. There are thus three factors in each case —age, height, weight. A child of more than average weight for his height may yet be under-grown for his age. He may have been systematically under-nourished, but from improved feeding shortly before weighing, he may have increased his weight beyond the standard. The figures given afford many illustrations of these various problems.

6. *General Problem of Nutrition.*

Nutrition does not mean the same thing in the adult as in the child. In the adult, that is, where growth is complete, nutrition means the maintenance of function in all the organs as fully grown. In one sense, the tissues are perpetually growing; in another sense, they are stationary. In order that life may be sustained, the processes of metabolism, that is, the interchange of elements within the tissues, must proceed at a certain mean rate. If the body is to remain of the same weight, the amount of nutriment taken in must precisely balance the

amount of waste thrown out. That this may happen, the cellular elements constituting the tissues must be born, must live, and must die; but their life history may be completely accomplished without affecting the total weight of the organism.

Again, the adult may increase in weight without increasing in height. This, in a sense, is growth; but it is, as it were, local, not general, growth. The several organs may increase with exercise; for example, the muscles, the heart, the lungs. On account of increase in food, new tissues, for example fat, may be deposited. On account of disease changes, the amount of water in the body may become excessive, or tissue degenerations occur. All these involve an increase in the bulk of special parts of the body; but the increase would not be growth in the general sense unless the changes occurred in all three dimensions of the individual tissue-elements. The increase of weight in the fully grown, therefore, is practically due to increase in the volume of the soft tissues either by hypertrophy of the cellular elements of the particular tissues or by the deposit of new tissues.

In children, nutrition has a different significance. It is two-fold—it affects growth and it affects the immediate physiological condition regarded as for a short period constant.

The child must be considered from two standpoints, first, as a growing organism, and, second, as a fixed organism.

If a child is from birth, or from before birth, badly nourished, the whole process of growth, as we have seen, is interfered with. But, again, a child well nourished from before birth until, say, the age of six, may be starved of food for a short period—days or weeks. In the first case, the result will be general mal-nutrition, resulting in interrupted growth, imperfect development, &c. In the second case, the bony skeleton will have developed to its normal extent; but the want of food will have affected all the soft tissues in such a way that the child loses weight rapidly without decreasing in stature. The

first child will be diminutive; the second will be starved. In both cases there is a problem of nutrition; but it is obvious that the problem is not the same in the child that from before birth has been wrongly fed and in the child that for a week has been partially starved. For the purposes of analysis, therefore, we may always regard the child from two standpoints—first, as a growing organism with a past and a future; second, as a grown organism capable, as a whole, at any given period, of certain physiological functions. The significance of nutrition will depend on which point of view we occupy in the particular investigation. It is always necessary to remember that occasional hunger or partial starvation is not the same thing as persistent mal-nutrition extending over years.

As we have said, the various parts of the organism attain to maturity at different times. The bony skeleton determines height. The bony skeleton *plus* all the soft tissues (the viscera) determine weight. For the reasons already given, height is less readily variable than weight.

7. *Rate of Increase in Height.*

Height increases at a varying rate from birth, or rather conception, until about the twenty-third year. As it depends on the relatively constant hard tissues, the bones, it affords the chief basis for estimate of development. It indicates in a measurable way the effect of persistent selection by environment. In the child, this is especially the case. The bones are then growing rapidly, they are almost as sensitive as the soft tissues to the influence of food, air, and light, and they determine in some degree the possible growth of the soft organs. The ultimate condition of the bony skeleton depends on prolonged nurture. After a certain stage, the volume of the bones is practically unalterable either by food or exercise. It is obvious that where growth has been perverted by disease, such as rickets, the measurement, height, and weight must be supplemented by direct inspection of the body. In other words, height and weight in relation to

age are a safe index of nutrition only when the body is free from general constitutional disease.

From the detailed tables, the rate of growth in infancy and adolescence may be deduced. Growth is continuous from the moment of conception to adult life. The average point when growth ceases has been fixed differently by different observers. Quetelet fixes it at 30 years for men, 25 for women; Roberts, 22 for men, 19 for women; Baxter, 35 for men, 19 for women; Villermé, 23 for men, 19 for women; Liharzin, 25 for men, 19 for women; Committee of Anthropometry (British Association), 23 for men, 20 for women.—(Richet, *op. cit.*, art. *Croissance.*) It is obvious that the rate of growth and the period of cessation are very inconstant. They must be ascertained for each race and for each group. In the application of these quantities to school children the main point of importance is that growth in height is most rapid in the period before the twentieth year. In the application to army recruits, the period of ended growth is of greater importance, since on it will depend the forecast of possible improvement in the undergrown. But both for school children and for recruits there is still abundant room for the accumulation of precise data.

Vierordt gives the following table showing the growth in the length of the skeleton, which, as we have seen, determines the height of the body. The figures, collected by Toldt, are taken from Maschka's "Handbuch der gerichtlichen Medicin," 3 Band, p. 559. "Daten und Tabellen," p. 64 :—

LENGTH OF SKELETON AT THE VARIOUS AGES.

Year.	Cm.	Year.	Cm.
1	50-72	11	128-136
2	68-81	12	133-141
3	78-89	13	138-145
4	85-98	14	142-150
5	94-104	15	145-157
6	102-112	16	148-165
7	106-116	18	152-167
8	112-121	Adult man,	157-180
9	117-127	Adult woman,	153-166
10	123-131		

The following tables show the average height in each

year of life. The figures are taken from Vierordt's "Daten und Tabellen," p. 6:—

AVERAGE SIZE IN EACH YEAR OF LIFE.

	Quetelet.		Zeising.	Beneke. Both sexes together.
	Male. Cm.	Female. Cm.	Cm.	Cm. Cm.
New born,	50·0	49·4	48·5	49—52
1 year,	69·8	69·0	75·7	68—72
2 years,	79·1	78·1	86·3	80—81
3 ,,	86·4	85·4	95·0	88—90
4 ,,	92·7	91·5	102·5	96
5 ,,	98·7	97·4	108·4	—
6 ,,	104·6	103·1	115·0	103—105
7 ,,	110·4	108·7	121·4	112
8 ,,	116·2	114·2	125·4	—
				Kotelmann. Male.
9 ,,	121·8	119·6	126·0	9-10 years, 128·58
10 ,,	127·3	124·9	130·5	10-11 ,, 130·75
11 ,,	132·5	130·1	132·3	11-12 ,, 135·06
12 ,,	137·5	135·2	136·0	12-13 ,, 139·91
13 ,,	142·5	140·0	143·7	13-14 ,, 143·09
14 ,,	146·9	144·6	148·6	14-15 ,, 148·88
15 ,,	151·3	148·8	154·0	15-16 ,, 154·19
16 ,,	155·4	152·1	161·5	16-17 ,, 161·65
17 ,,	159·4	154·6	164·0	
18 ,,	163·0	156·3	167·2	
19 ,,	165·5	157·0	169·0	
20 ,,	167·0	157·4	171·5	
25 ,,	168·2	157·8	173·1, 21 years.	
30 ,,	168·6	158·0		
40 ,,	168·6	158·0		
50 ,,	168·6	158·0		
60 ,,	167·6	157·1		
70 ,,	166·0	155·6		
80 ,,	163·6	153·4		
90 ,,	161·0	151·0		

8. *Rate of Increase in Weight.*

As we have seen, weight indicates the immediate condition of the tissues; but two children of the same weight may have had very different histories. Weight may depend on prolonged nurture, subject to certain limits of growth, or on immediate nurture. But when sufficiently comprehensive averages are taken, it is found that children of a given age in any given community approximate to the same standard weight. Interpretation of the weight must depend on supplementary observations of the muscular condition, fatness, presence or absence of

disease, amount of work, exercise, and other circumstances.

The following table, taken from Vierordt (*op. cit.*, p. 13), shows the body weight (in kilogrammes) for each year of life. The weight of clothing is deducted. "In the male sex, Quetelet reckons the clothing at one-eighteenth, in the female sex at one-twenty-fourth of the total weight. Roberts takes, in round numbers, 9 lbs. (or 4083 grammes) for the grown. Kotelmann (in gymnastic pupils) reckons the clothing at one-twentieth of the body weight. Bowditch, for boys of 5-8 years of age, reckons the clothing at 6·5 to 7·2 per cent. of the body weight; for girls, at 6·5 to 7·5 per cent. For boys of 9-12 years, he allows 7·9 to 9·9 per cent.; for girls, 6·8 to 6·9. For boys of 13-15 years, 7·8 to 8·4 per cent.; for girls, 5·8 to 7·3 per cent.

"According to Bowditch, the weight of the boy is greater up to the twelfth year; then, at the age 13-15, the average girl outweighs him by 1·7 kilogrammes."—(Vierordt, *op. cit.*, pp. 13-14.)

Body Weight in Kilogrammes in each Year of Life. (Quetelet)—Clothes Deducted.

	Male.	Male. Older Table.	Female.	Female. Older Table.
New-born	3·1	3·2	3	2·9
0-1	9	9·4	8·6	8·7
2	11	11·3	11	10·7
3	12·5	12·5	12·4	11·8
4	14	14·2	13·9	13
5	15·9	15·8	15·3	14·4
6	17·8	—	16·7	—
7	19·7	20·5	17·8	20·7
8	21·6	22·8	19·0	21·6
9	23·5	26·2	21·0	25·0
10	25·2	24·5, 29·3	23·1	23·5, 26·9
11	27	30·3	25·5	29·4
12	29	32·2	29	31·9
13	33·1	34·5	32·5	35·9
14	37·1	37·6	36·3	39·6
15	41·2	43·6, 42·3	40	40·4
16	45·4	46·8	43·5	48·9
17	49·7	52·3	46·8	51·6
18	53·9	57·6	49·8	54·6
19	57·6	61·3	52·1	56·3
20	59·5	60·1, 63·3	53·2	52·3, 54·4
21	61·2	65·2	54·3	57·7

	Male.	Male. Older Table.	Female.	Female. Older Table.
22	62·9	—	54·8	—
23	64·5	—	55·2(?)	—
25	66·2	62·9	54·8	53·3
27	65·9	—	55·1	—
30	66·1	63·6	55·3	54·3
40	—	63·67	—	55·2
50	—	63·5	—	56·16
60	—	61·9	—	54·3
70	—	59·5	—	51·5
80	—	57·8	—	49·4
90	—	57·8	—	49·3

In the report by the Royal Commission on Physical Training (Scotland) will be found masses of figures taken from the Anthropometrical Committee's researches and from other sources. The following table from the Commission's Report shows the heights and weights:—

Comparative Table of the Height and Weight of British, American, Aberdeen, and Edinburgh School Children.

	Ages.	British Population. Roberts.	Boston School Children. Bowditch.	Aberdeen School Children. Hay.	Edinburgh School Children. Mackenzie.	London School Girls, English. Mrs. Bryant.
		Ins.	Ins.	Ins.	Ins.	Ins.
Height—Boys, -	6-9	45·67	46·15	46·0	44·52	...
,, Girls, -	6-9	44·64	45·89	45·4	44·51	...
,, Boys, -	9-12	51·68	52·10	51·2	50·20	...
,, Girls, -	9-12	50·96	51·72	50·9	49·93	53·66
,, Boys, -	12-15	57·07	58·34	57·3	55·26	...
,, Girls, -	12-15	57·74	58·74	57·4	55·65	60·61
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Weight—Boys, -	6-9	49·6	49·68	51·1	46·60	...
,, Girls, -	6-9	47·1	48·25	47·9	45·62	...
,, Boys, -	9-12	66·6	66·32	64·0	59·53	...
,, Girls, -	9-12	61·8	63·95	60·9	57·76	...
,, Boys, -	12-15	83·7	89·12	84·5	74·02	...
,, Girls, -	12-15	86·7	90·95	83·3	78·36	...

The figures of this table, it is important to remember, are not all on the same plane. The averages by Roberts and Bowditch for Britain and America respectively are based on the examination of thousands of children; the

averages for Edinburgh and Aberdeen are based, for the most part, on examinations of groups of one hundred.

The table is of value, because it enables us to estimate how far the selected groups fall below the average of all classes. But for a fuller estimate of the comparative value, it is essential to study the cities more in detail. As we have already shown, 600 children, however selected, do not form a wide enough basis for conclusions regarding the 30,000 and 25,000 of Edinburgh and Aberdeen respectively. But the variations in the height and weight of the 600 show what are the extremes to be expected; and a further study of the Edinburgh and Aberdeen reports yields many fruitful correlations among the children of each city. However inadequate for comparison with more extended averages the figures may be, they are perfectly adequate for exhibiting contrasts within the special groups. This is brought out very strikingly in two tables—one showing the comparative heights and weights for each of the four Edinburgh schools, the other showing the numbers that deviate by more than five per cent. from the average. This mode of presenting the quantities was suggested by Professor Hay, and has been found to yield very definite verifications of inferences made on other grounds.

For Edinburgh, the substance of these tables has been given on pages 167-9. For the Aberdeen tables we must refer to the report; but we quote Professor Matthew Hay's observations:—

"As the numbers examined at the different ages were small—only thirty-two to thirty-four at each year of age for each sex—the average measurements would probably undergo some modification if they were derived from larger numbers, but the numbers are probably sufficient to afford ground for broad generalisations.

"*Height* (*standing*).—The boys were about 2 cms. or $\frac{1}{2}$ inch taller than the girls at the earlier ages; but the girls were taller than the boys at the ages of thirteen to fourteen and fourteen to fifteen. In other words, during the school-age period girls grow more than boys. This is

in accordance with the findings of previous observers (see especially the reports of the Anthropometric Committee in the British Association reports for 1879 to 1883).

"Compared with the measurements for 'all classes' collected by the Anthropometric Committee, which were chiefly for English children, the height in Aberdeen was fully 1 inch above the average at the first two years of age (six and seven years) in the accompanying tables, and about equal to the average at other ages. It was about ½ inch to 1 inch above the average at every age for the artizan classes of towns; but, at the higher ages, it was 1 inch to 2 inches less than that for the professional classes.

"*Height* (*sitting*).—The measurements appear to show that in both sexes the limbs grow slightly faster than the trunk. At six to nine years the proportion of height sitting to height standing was as 1 : 1·81 in boys, and as 1 : 1·80 in girls; at nine to twelve years it was in both sexes as 1 : 1·85; and at twelve to fifteen years it was in boys as 1 : 1·89, and in girls, as 1 : 1·88.

"*Weight.*—The boys were at every age heavier than the girls, except at the age of thirteen to fourteen. The statistics of the Anthropometric Committee show that this is usually true, except that girls at both thirteen to fourteen and fourteen to fifteen are distinctly heavier, as they are also taller than boys. The increase of weight with advance of age appeared to be irregular, but was most pronounced in both sexes in the later years of school life. Weight increased more rapidly than height—the height (in inches) being to the weight (in lbs.), at six to nine years, as 1 : 1·1; at nine to twelve years, as 1 : 1·23, and at twelve to fifteen years, as 1 : 1·5. The ratio was slightly less in respect of weight among girls than boys in each age-group. These ratios agree closely with the averages of 'all classes' obtained by the Anthropometric Committee, except that the weight ratio was higher among boys than girls during the last age-group."
—(Rep. of R.C.P.T.S., p. 115.)

9. *Relation of Height to Weight.*

In the fully grown, the relation of height to weight is approximately constant. In the growing, it is constantly changing. But when averages of sufficiently comprehensive measurements are taken it is found that at any given age the relation of height to weight is constant enough to furnish a standard of comparison. The averages constituting the standard are the nearest approach to " ought-to-be " that can be obtained. General physiological theory does not enable us to foretell to what height an individual ought to grow. This must be ascertained empirically by the laborious comparison of the heights that men actually attain to.

The relation of height to weight can be expressed in a single figure, which forms a valuable index for comparative purposes. Quetelet has elaborated this from a vast number of measurements :—

RATIO OF BODY-WEIGHT TO BODY-HEIGHT.

	Males.		*Females.*	
Height. (Metres.)	Weight. (Kilogrammes.)	Ratio.	Weight. (Kilogrammes.)	Ratio.
0·5	3·2	6·19	2·91	6·03
0·6	6·2	10·33	—	—
0·7	9·3	13·27	9·06	12·94
0·8	11·36	14·2	11·21	14·01
0·9	13·5	15	13·42	14·91
1·0	15·9	15·9	15·82	15·82
1·1	18·5	16·82	18·30	16·64
1·2	21·72	18·10	21·51	17·82
1·3	26·63	20·04	26·83	20·64
1·4	34·48	24·63	37·18	26·63
1·5	46·29	30·86	48	32
1·6	57·15	35·72	56·73	35·45
1·7	63·28	37·22	65·2	38·35

" Krause calculates that, in well-proportioned bodies, for each kilogramme of increase in weight there is about 3 centimetres (to be precise, 2·9139) of increase in height." —(Vierordt, *op. cit.*, p. 14.)

The relation between height, weight, and chest-girth is important, and it may be introduced here. Bornhardt,

as the result of an examination of recruits, arrived at the following formula:—

Let H = height.
C = chest girth (in centimetres), measured over the nipples.
P = weight in kilogrammes.

Then, in an adult, the weight to be expected (and in the stronger constitutions excelled) may be deduced from the formula

$$P = \frac{HC}{240}$$

This is for average constitutions.—(Vierordt, *op. cit.*, p. 14.)

How far a similar formula may be applied to the growing is a matter for calculation. In any case, it is obvious that with a measurement so easily affected by exercise as the chest-girth is, averages can be relied on only when the observations are of vast extent. Probably, in children, the direct examination of the chest and the state of nutrition will yield better grounds for practical advice.

In using the tables, it is necessary to remember that after all the figures are averages. The upward or downward variation of any individual child cannot, therefore, be counted as favourable or unfavourable unless other circumstances confirm the inference. A very small child may be very well-nourished; a very tall child may be very ill-nourished. The relation of height to weight will always afford a certain indication of growth; but even this must be compared not only with the general averages over a series of races, but also with the averages of the races nearest to the particular community.

10. *Special Application to Children.*

The rate of growth is affected by exercise and by food. Accordingly, even in growing children, height and weight are an index not only of growth, but of nutrition—growth

itself being an index of nutrition. So far as school children are concerned, the fundamental questions demanding an answer are as follows:—

(*a*) Is the child fully grown for his age, that is, has he attained to the standard height and to the standard weight?

(*b*) If not, does he give evidence of arrested growth?

(*c*) If he does, is the arrest due to hereditary causes, or to environmental causes?

(*d*) If to hereditary causes can these be specified? Is there any evidence of inherited disease, or of disproportion of organs, or defect in organs, &c.?

(*e*) If to environmental causes, is there evidence of specific diseases, such as rickets, &c.? Is there evidence of under-feeding, or drugging, or defective exposure to air and light, or of wrong quality of food, &c.?

In particular localities, the predominance of one or other of these factors will be manifest. That they should all constitute relevant questions here proves the paramount importance of height and weight, which carry all the other questions with them.

11. *Qualifying Considerations.*

In consideration of height and weight, it must be remembered that they are evidence of two things, first, of the stage of growth, and, second, of the state of nutrition. Growth and nutrition are inter-related; but they must not be confused. In his elaborate researches into the diet of poorhouses, Dr. Aitchison has shown that the nutrition of adults varies not only with the quantity, but also with the quality of the food. This is abundantly proved by many observers. In his investigations into prison diets, Dr. Crauford Dunlop has shown that weights can be kept constant by giving quantities of properly constructed diets. These are illustrations of nutrition. On the other hand, a given child can be kept alive on a minimum quantity of food; or he may be fed on an excess of food. On the minimum diet, his growth may not be appreciably

diminished; on the excess diet, it may not be appreciably increased. Certain variations there will be, but the total arrest of growth means death, and over-rapidity of growth means disease. Growth, therefore, although affected by nutrition, can be so affected only within certain narrow limits. Beyond these, the moving equilibrium of the organism is so disturbed that life ceases to be possible.

12. *The Effect of Exercise on Growth.*

That exercise has some influence on growth scarcely needs demonstration; but its influence may very easily be misread. It is apt to be assumed that the only exercise affecting growth is the exercise systematically given in drill classes or gymnasia. It is easily forgotten that the child is for all his waking hours constantly indulging himself in physical exercise. The special value of exercises scientifically arranged is that they are proportioned to the bodily powers at every age; that they provide for the equal and harmonious growth of all the great physiological systems; that they are kept strictly subordinate to the primary purpose of all exercise in the growing child, namely, the promotion of correct nutrition.

13. *Exercise affects Weight rather than Height.*

This is shown by the figures collected by H. B. Beyer, Annapolis. By a "comparison of 188 cadets who, during three years, underwent special gymnastic training, with 4537 cadets of preceding years, who underwent no training, he found that the increase in height, per individual, was only 26·6 millimetres, while the muscular force was five times greater. It may be added that the effects of exercise vary according to the age, and it is possible that exercise may at certain times affect height as well as weight."—(Richet, *op. cit.*, art. *Croissance.*)

The effects of exercise, however, on growth must be looked for in the expansion of the chest and in the improvement of bodily shape as well as in the mere increase of bulk or muscle.

14. *Effects of Exercise depend on Hygiene.*

Height at any given year of the growing may be affected by physical exercise; but the effect is mainly indirect. Physical exercise within sound limits improves the nutrition of the body and thus probably accelerates growth. Whether the growth-rate of the skeleton is really much affected is a matter for observation. It is certain that exercise in hygienic conditions acts as a preventive of rickets, anæmia, tubercle, and other diseases that might interfere with growth. But such exercise implies feeding, proper housing, proper clothing, and proper cleansing. Where all these conditions are fulfilled, it is a frequent experience that physical exercise stimulates growth in height as well as bulk. Height, however, can never be taken as a test by itself. It must be taken in correlation with weight.

Weight is rapidly affected by physical exercise in the conditions named. Where, however, these conditions are not realised, physical exercise may result in loss of weight. Weight depends mainly on the size of the skeletal bones, and the size of the muscles. The other organs are of less account. Exercise affects mainly the size of the muscles. It does so by increasing the muscular and the nervous work, and in consequence the muscular and nervous waste. The value of such work and waste for nutritional purposes depends entirely on the supply of food. If this is not suitable in quantity and quality, the increase of exercise results in uncompensated waste of muscle and nerve, and consequent exhaustion. In growing children, this fact is of more importance than in the grown. For the growing child has not only to absorb and assimilate the food necessary to maintain the normal rate of growth; he has also to absorb the extra supply necessary to compensate the muscular and nervous waste in exercise. In the child, growth and exercise are so intimately related that it is difficult to estimate within what limits exercise increases growth or retards it.

Exercise must be graduated to the condition of the

child. Weight will be an index of the correctness of the graduation. In no case should children be subjected to persistent daily physical drill without periodical examinations for weight.

15. *Exercise and Food.*

Accordingly, in estimating the significance of the weight of school children, the medical inspector must take account of social conditions, of food, of exercise, and of work. Rapid loss of weight means disease or over-work. Arrest of growth means in most cases bad nurture or over-work.

Great growth of muscle under exercise, with loss of fat, may mean wrong quality of food.

It is not uncommon to feed growing children on the same food as their parents consume. This in many cases means that the amount of nitrogenous food supplied is too small and the amount of carbo-hydrates too great. Where increase in bulk by growth is aimed at, the foods that constitute muscle-tissue and nerve-tissue should predominate. Where output of energy from the muscles as they exist is the object, carbo-hydrates must predominate. It is clear, therefore, that the question of exercise in its relation to growth and nutrition is a question fundamentally of food. In the figures already given from the Edinburgh report, it appears that even where the amount of exercise is approximately the same, the growth and nutrition show great differences. These differences are in general correlated with differences in social condition, which means differences in food and housing.

These facts indicate that, apart altogether from the question of disease, it is important to examine from time to time the weight of children. Variations in weight may be the occasion for offering advice on the quantity and quality of the food. In cases of acute disease, such as incipient phthisis, food is of paramount importance.

16. *Influence of the Seasons on Growth.*

Neither height nor weight increases uniformly through

the seasons of the year. It is common knowledge that, even in adults, weight varies considerably in correspondence with the seasons. In children the rate of growth varies, but the seasons most favourable to growth in weight are not so favourable to growth in height. Malling Hansen has observed that height increases by stages separated by periods of rest. So with weight. Further, during the period of increase in height, the increase in weight ceases, and *vice versa.* "The weight attains its maximum in September; it appears to remain sensibly in equilibrium from December to April. The maximum of growth in height corresponds with the minimum of increase in weight. The vital forces do not work in both directions at once. During autumn and the beginning of winter, the child accumulates weight; but the height remains stationary. At the commencement of summer, the weight remains almost without change; but the infant shoots out in height, like the trees."

These observations, which are confirmed by other researches, are of great biological interest, but they are adduced rather to indicate how much depends on the measurement of height and weight than to suggest any practical application in the medical inspection of schools. When in any school a series of measurements is taken, the influence of the seasons might well lead to fallacious inferences if the quantities should be compared with measurements taken in another locality and another climate at different seasons. It is, therefore, well to keep in view that "autumn is the period of maximum growth in weight and of minimum growth in stature; spring is the period of minimum growth in weight and of maximum growth in stature; winter is the period of moderate growth in stature and weight simultaneously." —(Richet, *op. cit.*, art. *Croissance.*)

17. *Influence of Disease on Growth.*

In any exceptional case of over-growth or undergrowth, the medical inspector will at once ask—Has disease played any part here? He will distinguish the effects of

chronic from the effects of acute disease. The chronic diseases that affect growth are such as rickets, anæmia, congenital specific disease, tuberculosis, throat and nose diseases, &c. Acute diseases of all varieties affect growth in some degree. The acute infections usually result in a rapid acceleration of growth in height, and ultimately of growth in weight. The chronic diseases, *e.g.*, rickets, usually retard growth both in height and weight.

Many important problems arise out of the relation of growth to disease. We do not propose here to discuss them. It is enough to direct attention to the importance of recording, for every case, the existing and past diseases. With existing diseases, there will be no difficulty. With past diseases, there may be much difficulty. As a rule, it may be assumed that the majority of children over twelve have had measles and whooping-cough; that a very large proportion have had chicken-pox; that a large proportion have had scarlet fever. The other infections—typhoid fever, typhus fever, diphtheria, erysipelas—affect much smaller proportions of children. Diphtheria, however, is in great measure a school disease; its permanent consequences are frequently serious, and, as it is one of the most fatal of the "throat diseases," it ought always to be carefully sought for. Local and seasonal epidemics will always be a guide in scouting for infectious disease.

Of the other varieties of acute disease affecting growth the number is too small to cause confusion in the results of measurement.

18. *Growth in relation to School Efficiency.*

Height and weight are important in estimating the school efficiency of the child. The child that is growing too rapidly is not equal to the same strain as a normal child. He should not be pressed into the same work, either intellectual or physical, as normal children. Otherwise, exhaustion and break-down will follow. Growth must not be interfered with if ultimate good physique is to be secured. The normal tendency is to work a child, and to let him work, as if he were already an adult. It

is not, however, so much the quantity of work as the kind of work that is important. The education of the child must proceed on the scientific analysis of his capacities. He must be educated to breathe and to digest as well as to exercise his external muscles. He must not be subjected either to conditions or to tasks that retard growth either by reducing the food or by impairing his capacity to assimilate. In the large sense, food includes all the nutritional elements available, the oxygen of the air not least.

As the child approaches the end of elementary school life, he should be examined periodically. He should be more strictly supervised both in his physical and in his intellectual activities. Otherwise, the great physiological, intellectual, and emotional expansions preceding puberty may result in serious loss of balance in growth.

19. *Standard Tables of Height and Weight.*

Every school should be provided with standard tables of height and weight. The meaning and value of these should be taught as an ordinary part of school training. From the experience gained in examining 600 children, we consider that the children can without any difficulty be stimulated to interest themselves in their heights and weights as much as in the interesting games. The fundamental facts cannot be too thoroughly taught, and the teacher will usually find that the child's personal interest in his own progress will make the teaching easy.

The measurement of height and weight is so simple that it ought to become a routine practice of every school. The data thus resulting would be of incalculable value for an estimate of physical progress or deterioration. Height is relatively constant; weight is relatively variable. Height thus becomes a more valuable test of individual or racial degeneration or deterioration of physique; weight is a better index of the immediate state of nutrition.

20. *Conclusion.*

In this chapter, an effort has been made to set forth the cardinal value of the height and weight as measures of physical progress. On them we must rely; to them we must always return. Generalities on food and housing and occupation are but the beginning of the case. They must be brought to the test of the steel-yard and the foot-rule. The phrase "vital statistics of the school ages" should no longer mean only the death-rates and disease-rates. It should mean also the growth-rates. In this matter, the great public schools all over the Western world have led the way. It is imperative that the other schools should follow. Where methods are so simple, management should be easy. With a nominal outlay every school may become a bureau of scientific observation. If the principles and illustrations we have given have any value at all, they carry at least one conclusion—The first step in the school education of the people is to weigh and measure the school children.

Note.—The admirable article, *Croissance*, so largely drawn upon, is to be found in M. Richet's "Dictionnaire de Physiologie," vol. iv., over the signatnre of Dr. G. Bonnier.

APPENDIX.

The following table will be of service in the conversion of English into French and French into English quantities:—

Inches.		Millimetres.		Centimetres.
$\frac{1}{8}$ or ·125	=	3·18	=	·318
$\frac{1}{4}$,, ·25	=	6·36	=	·636
$\frac{3}{8}$,, ·375	=	9·52	=	·952
$\frac{1}{2}$,, ·5	=	12·71	=	1·271
$\frac{5}{8}$,, ·625	=	15·87	=	1·587
$\frac{3}{4}$,, ·75	=	19·06	=	1·906
$\frac{7}{8}$,, ·875	=	22·2	=	2·22
1	=	25·39	=	2·539
2	=	51	=	5·1
3	=	76	=	7·6
4	=	102	=	10·2
5	=	127	=	12·7
6	=	152	=	15·2
7	=	178	=	17·8
8	=	203	=	20·3
9	=	229	=	22·9
10	=	254	=	25·4
11	=	286	=	28·6
1 foot	=	305	=	30·5
2 feet	=	610	=	61·0
3 ,,	=	914	=	91·4
4 ,,	=	1219	=	121·9
5 ,,	=	1524	=	152·4
6 ,,	=	1829	=	182·9

Millimetres.		Centimetres.		Inches.
1	=	·1	=	·039
10	=	1·0	=	·394
20	=	2·0	=	·787
30	=	3	=	1·18
40	=	4	=	1·57
50	=	5	=	1·97
60	=	6	=	2·36
70	=	7	=	2·75
80	=	8	=	3·15
90	=	9	=	3·54
100	=	10	=	3·94
1000	=	100	=	39·4

CHAPTER IX.

The School as Immediate Environment.

1. *Inspection of the School in Relation to the Child.*

The inspection of a school may be conducted from two standpoints—the standpoint of structure and the standpoint of function.

The standpoint of structure is the standpoint of the ordinary sanitary inspection of school buildings. This takes account of the site, the methods of preventing dampness in walls and in floors, the structure of the walls, roofs, floors; the amount of lighting area, the floor area, the cubic space, the methods of ventilation, the methods of warming, the sanitary appliances, lavatories, cloakrooms, playgrounds, &c. The system of building bye-laws current in the district is applied in detail to the structure of the premises. These must satisfy both the regulations of the public health local authorities and the special conditions of the central education authority. All this is the routine work of the authorities named, but it is all done without regard to the actual occupation of the school by an actual child. Every element in school-structure is designed to meet some hygienic or educational requirement; but in any particular case, the absence of some element may not have any effect of a calculable kind on the individual health of the children. None the less is it important to record the precise structural conditions of sanitation. But this is not the work of the medical inspector of school children.

The standpoint of function is the more important standpoint for the medical inspector. He concerns himself rather with the functions than with the structure of the school. He aims at discovering the effects of school

conditions on the life of the child within school hours. He is not indifferent to site, or walls, or roofs, or lighting, or the systems of ventilation, or warming; but he judges these by their influence on the living, concrete children to be examined. The question he must answer is not—Is the school built in accordance with good hygiene? but —How is this individual child affected by daily exposure to this immediate environment? He investigates the physiology, not the anatomy of the school. The best of schools may be badly managed. The worst of schools may be well managed. The most perfect system of ventilation may give worse results than the most rudimentary. On the average, this is not so; but the medical inspector must take nothing for granted. The modern schools offer, as a rule, every facility for good hygienic management, but they do not manage themselves. Our point is that when the individual child's health is in question, the total effects of all the school influences must be taken into account.

2. *Primary School Functions.*

From the functional, or dynamic, standpoint, therefore, the medical inspector must consider the time of entry, the time of exit, the movements from room to room, from section to section, the amount of unoccupied time, the amount of it spent in the school buildings, the amount of it spent in the open air, the amount of it spent in the gymnasium, the amount of it spent at exercise, the total time at work, the proportion of relief to labour. These lead to other questions—the amount of dust, the cleanliness of the floors, walls, ceilings, benches, windows; the amount of light, air, heat; the temperature throughout the day. He will also observe the functional effects of the position of the benches; the relation to light; the effects of the light on the expression of the children; the distance between child and blackboard or reading-sheet, and similar related matters. He will not neglect the question of noise, and the methods of minimising it. In general, he will endeavour, as far as he can, to make

a functional analysis of the school during the hours of actual educational work. The odours will soon indicate whether the ventilation is good. The discomfort of the children will convey some hint of the sufficiency or non-sufficiency of the warming. The signs of fatigue at the end of a meeting will present a problem for solving in relation to the school-conditions. He will watch the playtime, that he may discriminate the more from the less vigorous. He will watch the exercises, that he may judge of their excess or defect or incorrectness. He will follow the child through the whole range of school-activities, that he may relate the concrete life to the concrete conditions of living.

3. *Facts to be recorded.*

The wealth of impressions thus gained cannot be recorded in full. The medical inspector must content himself with generalities; but the detailed observation of the functions named will enable him to estimate more exactly the facts gathered in his examination of the individual children. Spontaneously, a normal standard will form in his mind. His judgments will be kept sane and real. He will learn to characterise each child in the light of the whole organisation and structure of the school.

4. *Illustrations.*

For illustrations, we must refer to the Edinburgh and Aberdeen investigations. In these some effort was made to estimate the functional effects of the school. In the wide sense, the whole Report of the Commission, including the detailed studies, is an essay in the determination of functional effects of school conditions. Just as occupation determines in subtle ways the daily actions, and ultimately the habitual life of men, so the conditions of the school determine, in infinitely delicate ways, the formation of habits in the child. Probably, the investigation of these functional variations is a problem rather for the psychologist than for the medical physiologist. But

the fruitfulness of the field is beyond controversy. The special investigations for the Royal Commission took account only of the factors affecting physique; but as any one may learn from Chadwick's suggestions half a century ago, the effects of cerebral fatigue in school surroundings are perfectly proper objects of medical research. The illustrations, therefore, are not offered as more than a hint of what is possible when the interest of the observer and the suitable occasion coincide. (See Report of Royal Com. Phys. Train. (Scot.), vol. i., pp. 77 and 101. On Functional Effects of School Structure, see Newsholme and Pake's " School Hygiene.")

CHAPTER X.

EXAMINATION FOR MENTAL CAPACITY AND ATTENDANCE, &c.

1. *Results in Edinburgh and Aberdeen.*

IN Part I., chap. IV., we have indicated in what way the teacher may supply data for classifying children according to mental capacity. As an illustration of the results, we quote from the Edinburgh and Aberdeen reports :—

(*a*) *From Edinburgh Report.*

MENTAL CAPACITY.

"1. *Mental Capacity.*—In the Edinburgh schools it is not the custom to award precise merit places in class. The details ascertained in this regard, therefore, do not furnish any more exact information than the teacher's opinion of 'mental capacity.' The entries made were classified into good, medium, and bad, which would correspond roughly to upper third, middle third, and lower third. Of the goods, there were 51 per cent.; of mediums, 38 per cent.; and of bads, 10 per cent. If we compare this with the entries of teacher's opinion, we find that the 'excellents' and 'goods' together amount to 57 per cent., the 'mediums' to 30 per cent., and the 'bads' and 'defectives' to 12 per cent. These numbers correspond fairly with the goods, mediums, and bads as estimated from 'position in class.' The inference from the comparison is that the children selected were on the whole representative, and this is known to be the case on other grounds.

"For the different schools, the figures vary somewhat. Thus in South Bridge the 'goods in position' numbered

70 per cent.; in London Street, 44·6; in North Canongate, 28; in Bruntsfield, 61·6. The corresponding figures in terms of 'teacher's opinion' were—for South Bridge, 69; London Street, 50; North Canongate, 31; Bruntsfield, 65.

"For 'mediums in position' the figures are—South Bridge, 25 (teacher's opinion, 31); London Street, position, 40 (teacher's opinion, 50); North Canongate, position, 46 (teacher's opinion, 57); Bruntsfield, position, 27 (teacher's opinion, 30).

"The 'bads in position' were respectively 4·6, 14, 14·6, 7·5. 'Bads in teacher's opinion' were 8, 12, 22, 7.

"The outstanding feature of these figures is that North Canongate reckons only 28 'goods in position,' as against 44, 61, and 70 for the other schools, and 14 bads, which, however, is the same as London Street. Of the 'bads in teacher's opinion,' North Canongate reckons 22, as against 8, 12, and 7 for each of the other schools. This deficiency of 'goods' and overplus of 'dulls' and 'defectives,' or 'bads,' corresponds with all the other facts ascertained about North Canongate.

"In confirmation of these striking conclusions, it may be stated that during the process of the examination at North Canongate School it was noticed that the attention of the children was disturbed with extreme ease. Every little trifle was a distraction. The nervous restlessness was very marked. In South Bridge, on the other hand, while the readiness to fall into animated talk was very marked, restlessness, except as the result of surplus energy of muscle, was not particularly prominent. At London Street, the surplus muscular energy was strongly in evidence, but the capacity for sustained attention was good. At Bruntsfield, the restlessness was not prominent, and the capacity for attention was high. One simple test brought out these features:—While the examination of a child was going on, the others were told to watch the process so that they could hear the numbers. This request operated fairly well at South Bridge, very well at London Street, very well at Bruntsfield, and hardly at all at Canongate. In the last, the curiosity of the children rose above every other consideration.

"The general inference I draw from these phenomena in the light of the figures is that the restlessness and shifting of attention so characteristic of the North Canongate children are based in their insufficicntly nourished and over-stimulated nervous systems. They are older in experience than in years. They are extremcly alert, but not very continuous in attention. They are better adapted to the casual life of the streets than to the persistent system of school discipline.

"2. *Attendance.*—The feature of this part of the table is that the attendance is best for the nine to twelve group. This is capable of a general explanation. The younger children are more affected by conditions of weather, and the older children are more liable to be employed for home assistance. Those from nine to twelve are less liable on the whole to be affected by either of these well-known conditions.

"In a fair number of cases I was informed that both before and after school hours boys were employed as messengers or paper boys. But I found nothing to show that this fact affected the attendance seriously.

"In the individual schools, the attendance was as follows:—

	Good.	Medium.	Bad.
South Bridge, - - - - - -	118	24	8
London Street, - - - -	102	28	20
North Canongate, - - - - -	120	21	9
Bruntsfield, - - - - - -	126	15	9

—(Rep. R.C.P.T.S., vol. i., p. 79.)

(*b*) *From Aberdeen Report.*

"It will be observed that somewhat more than one-fourth of the children examined belonged to the top fourth of their class, while considerably under one-fourth of the children were drawn from the bottom fourth. The mode of selecting the children was probably, as already explained, in some measure responsible for this. The children examined in Aberdeen were, therefore, as a wholc, somewhat above the average in class place, and this was truc more especially of the girls.

"In respect of mental capacity, 59 per cent. were marked as being 'excellent' or 'good,' while only 9 per cent. were entered as 'dull.' None were marked as 'defective.'

"The 'dull' children belonged equally to the various social grades, and were not under the average in respect of health appearance, regularity of attendance, and cleanliness. Nor did their average measurements, which were separately made up, differ materially from the averages for other children of the same ages. They suffered, however, in distinctly larger proportion from eye and ear defects."—(*Ibid.*, p. 101.)

It is worth noting that in Edinburgh, of the whole children, 77·6 per cent. were reckoned as "good" in attendances; but only 17·5 per cent. were reckoned as "excellent" in mental capacity. If, however, we add the "excellents" and "goods," the total percentage rises to 57·3. There still remain 30·33 per cent. of "mediums," 11·5 per cent. of "dulls," and ·83 per cent. of "defectives." If the figures were closely analysed in detail, it would doubtless be found that the "excellents" and "goods" are among the best attenders, but that a large percentage of the mediums are also good attenders.

These quantities are sufficient to indicate that the careful tabulation and correlation of mental capacity and regularity of attendance may yield very rich results of a practical educational kind. Attendance, being compulsory, cannot be regarded *simpliciter* as an index of character; but if it were always found that the good attenders yielded a much larger proportion of "goods" in mental capacity, it would be justifiable to infer that steady attendance is a primary factor in the furtherance of education. On general grounds, this inference is already more or less justified; but an extended series of observations would give it greater precision. Nor this alone. The greater yield of good capacity, if thus made manifest in the figures, would be an effective stimulus both to parents and to school authorities to maintain

the attendance of children. The fundamental method of education is establishment of habits; habits can be established only by persistent repetition, and it were well if evidence were forthcoming that the steady habit of daily attendance on systematic instruction resulted in the improvement of those already "good" and the production of "goods" from among those already "medium."

2. *Defective Children, Epileptics, &c.*

The Scotch Education Code provides for the instruction of defective or epileptic children in special classes limited to twenty pupils. The classes must be specially reserved for such children. They must be taught by teachers specially approved by the Department for the purpose. In a note, the definition of defective children is given:—"By defective children shall be understood children who, not being imbecile, and not being merely dull or backward are defective—that is to say, children who, by reason of mental or physical defect, are incapable of receiving proper benefit from the instruction in the ordinary public elementary schools, but are not incapable by reason of such defect of receiving benefit from instruction in such special classes as are mentioned in this article (article 20). By epileptic children shall be understood children who, not being idiots or imbeciles, are unfit by reason of severe epilepsy to attend the ordinary public elementary schools."—(Scot. Educ. Dept., Code of Regs. for Day Schools, 1903, art. 20.)

By article 20, II. (*c*), "No child shall be admitted to the special class except upon the certificate of a duly qualified medical practitioner, approved by the Department, that the child in question is defective or epileptic, and provision must be made for the subsequent medical examination of the children at such intervals as the Department may approve."

In this article, the Education Code makes full provision for the medical inspection of defective children—defective physically or mentally to such a degree as to incapacitate them for profiting by the ordinary courses of instruction.

The Code does not specify how these children are to be discovered in the first instance. Presumably, the teacher finds them defective in capacity for class work. He cannot, of his own authority, form a special class; but the school managers may make provision for a special class, and children certified as defective may be admitted to it. Here we do not find any special arrangement for such medical scrutiny of the children admitted as would ensure that no defective child shall continue to be educated in a class that can confer upon it no benefit. Short of defect, there are many conditions of feeble-mindedness that demand careful consideration. It is doubtful whether, in such cases, the provision of special classes labelled "defective" is the best possible way of management. On the contrary, it may sometimes happen that children on the borderland of mental deficiency do benefit by association with normal children although not profiting intellectually. It is in those marginal cases where the physiological inheritance is doubtful, where nutrition is feeble, where growth is inadequate, that special medical examination is most called for. The medical inspection provided by the Code for children so obviously defective as to profit nothing by ordinary instruction ought also to be provided for all children. For the amount of feeble-minded, if not positively defective, children in our ordinary day schools is not inconsiderable. This form of feeble-mindedness is not precisely covered by the term "defective." Further, the term defective may include those that are mentally sound, but physically incapable of keeping pace with ordinary classes. Blind children and deaf-mutes are specially provided for by the Code. In some cases of heart or lung disease recorded, the children might in some sense be counted defective physically; because it is certain that in the course of school life they suffer by school work. It is, however, obvious that the association of cases that suffer from congenital or acquired heart disease with children defective from imperfect development is not to be lightly encouraged.

3. *Feeble-Minded Children.*

That the mental unfitness for education, named for want of a good technical term, "feeble-mindedness," is a real quantity in any school population even casual inspection is sufficient to establish. Miss Mary Dendy, who, in Manchester and London, has been for many years studying the question of feeble-mindedness among school children, has amassed a considerable number of facts. She shows, by numerous individual instances, that the ordinary school organisation is not equal to the management of these children on sound lines. She also shows that the mental defects are in very many cases accompanied by obvious physical defects. The ranks of the criminal classes are continually recruited from the feeble-minded. The want of inhibition, the want of will, the readiness to obey irrationally, the absence of any sense of right or wrong, the incapacity to be educated into the ordinary routine of a school, or of a society, without constant direction from a stronger mind—these are some features of the feeble-minded children.

Miss Dendy, in a paper read at the Edinburgh Conference of Women Workers, 1902, writes:—

"In a review of a paper by Mr. Butler we find the following words:—

"'But school age ceases at sixteen, and then follows the perilous period in which the animal passions become those of the adult whilst the controlling power too often remains that of the child. Without adequate protection the feeble-minded lad, but especially the feeble-minded girl, easily falls into vicious courses, and one perverted feeble-minded woman is a source of contagion to all around. Mr. Butler gave some remarkable statistics, chiefly gathered from the records of the Board of State Charities of Indiana, as to the increasing number of illegitimate children of feeble-minded parents, and as to the inheritance of feeble-mindedness. In 511 families in which there was known to be feeble-mindedness there were 1924 persons (an average of 3·76 to a family)—889

males and 1033 females. [These two groups, however, amount only to 1922.] Of these, 522 males and 717 females were feeble-minded, 21 men and 33 women were insane, 44 others were defective physically—that is, blind, deaf, paralytic, epileptic, &c. In a number of cases there were combinations of forms of defectiveness. Among these families 267 members were known to be illegitimate. In the aggregate, 577 only of the 1924 members of the 54 families were not recognised as defective in some respect.

"'Such appalling statistics strengthen the case for prohibitive legislation against the probable marriage of defectives, which has already been accepted by some, at least, of the American State Legislatures; but this will not meet the case of propagation of the unfit by means of illicit unions. The real remedy seems to lie in the early recognition of defectives and their life-long supervision. Educational efforts alone fall short of what is required to protect society from the taint of feeble-mindedness. They will help to diminish the dependent condition, and it may be hoped also the delinquent tendencies of the feeble-minded class; but it is only by some scheme of industrial colonies where defectives can be usefully employed in segregation from the ordinary population that the maximum of benefit to the community can be obtained.'"—(Papers read at Conference of Women Workers, Edin., 1902, p. 116-7.)

Miss Dendy continues:—"My attention was first called to this subject five years ago, when, as a member of the Manchester School Board, I spent a good deal of time in the elementary schools of the city. Noticing the children closely, I found that there were many who were quite incapable of taking in the lessons given in the standards. If I told the class a story, they did not laugh with the others. In the playground, they hung listlessly about. In speaking to them, I did not feel that they responded to what I said as children usually do. It appeared to me that children such as these, passing through the schools without acquiring either knowledge

or the powers of self-direction, accounted to a great extent for adults such as that girl of whom I spoke, the daughter of a deaf-mute mother. I began to collect some statistics as a basis for action, and I must own the facts appalled me. First, I visited the houses of all the children who were excused school attendance because of mental disability. One boy, a pretty little fellow, was lying in a heap of filthy rags under a kitchen window. He was not dressed. You see parents such as this child's, often themselves not of normal intellect, do not consider it necessary to dress their children when they know that the school-attendance officer will not call; they put the little ones to bed and pawn their clothes. Another was brought to me from a bed upstairs. He also was not dressed, and was blinking so from the unaccustomed light that he could not see me. Two brothers, aged twenty-three and fourteen, were also defective, and the mother was not sane.

"Dr. Shuttleworth kindly read my report on all the cases, and made notes as to what ought to be done with each child. In 1898, there were 100,322 children on the books of the public elementary schools. Of these, 44,463 were in the Board school. I now proceeded to make an inspection of all these Board school children, and I saw, at their work, all who were in actual attendance, 39,600. When I saw a child who seemed to be abnormal I made a special examination of it, speaking also to normal children so as to avoid singling out any one for remark. With the aid of an attendance officer, I took down all particulars concerning the child. In this way I made notes on 525 children. This report would, of course, not in itself have been reliable evidence. But when it was complete we were so fortunate as to secure the help of Dr. Ashby, our great children's doctor, the head physician of our Children's Hospital, a man whose opinion is acknowledged to be the best possible. He most kindly consented to see all my cases. He examined every child carefully, and gave a written opinion on each. He summarised the result thus:—'Out of 500 examined, 214

were dull and backward (it being understood that the backwardness arose from the child's condition, not from home condition), 276 were mentally feeble, 4 were deaf-mutes, 6 did not appear to be sufficiently behindhand to come under either of these terms.'

"This means that in Manchester, adding the proportion of children to the voluntary schools, we have about 1000 children who are mentally unsound in the day schools at one time. Since then, I have worked in a similar manner through all the voluntary schools in a large non-School Board area, with similar results. Wherever an attempt has been made to obtain correct statistics these figures are confirmed."

The length of these quotations is excused by their immense importance. The method used to discover the feeble-minded is open to any school authority at any time. Its thoroughness is proved by the results.

It is seen that at a certain stage of the investigation medical assistance became necessary. In the course of medical inspection, the feeble-minded children are discovered partly by the teacher and partly by special inspection. The ordinary routine of the school always reveals the mentally dull or defective; but the causes of the dulness or defects may not always be the same, and the differences are always a proper subject for medical investigation. As Mr. Butler points out, "The real remedy seems to lie in the early recognition of defectives and their life-long supervision. Educational efforts alone fall short of what is required to protect society from the taint of feeble-mindedness." This, however, raises a question that lies beyond the scope of this book; but it shows the supreme importance of knowing at an early stage those that from mental deficiency may become a danger to society. (In the Rept. of R.C.P.T.S., vol. ii., p. 595, Miss Lily Monteagle, Glasgow, gives some important evidence on the methods of educating the feeble-minded.)

CHAPTER XI.

Examination for Personal Appearance and Cleanliness.

1. *Personal Appearance.*

As already indicated, this section of the schedule involves a detailed inspection of each child. The conditions specified in the schedule are somewhat difficult to define; but every one knows in greater or less degree what is intended. Errors of judgment, however, are here very easily made. No one condition, such as complexion, or health appearance, or muscular condition, should be judged by itself alone; each should be judged in the light of the others. First impressions are frequently incorrect. The examiner will do well to compare child with child, and to check his observations by the subsequent weighing and measuring. Paleness varies considerably in significance. So does thinness. It is difficult to give general directions in reference to qualities so subtle. Accordingly, we prefer to quote the description of the actual examinations made. Incidentally, these give hints of points to be sought or avoided:—

(*a*) *From Edinburgh Report.*

"(*a*) *Complexion.*—The inferences regarding personal appearance, cleanliness, &c., involve a high personal equation. In order that some uniformity of opinion might pervade the observations, I reserved this section of the schedule for myself. For much or for little, therefore, such error as there may be is fairly uniform. On a survey of the results, and a comparison of my recollections of the various schools, I have concluded that the standard varied a good deal without my being aware of it at the time. The examination began at South Bridge School.

The first school was naturally the occasion for the formation of a standard. Possibly I was rather more exacting in some respects than at the later schools. For example, I find that 69 cases of paleness are recorded, as against 68 for North Canongate, 62 for London Street, and 58 for Bruntsfield. These results do not quite correspond with the general impression formed of the schools. North Canongate would probably be found to yield a greater number of pale children than South Bridge if the examination were conducted with the groups of children standing side by side and made available for immediate comparison. On the other hand, I find that in South Bridge, 40 were recorded as ruddy in complexion. This is probably an over-estimate, for Bruntsfield shows only 42 ruddy and London Street shows only 35, while North Canongate shows 30. From a general impression, I should have said that the Bruntsfield children contained a considerably greater number of ruddy-faced children than South Bridge, and that London Street did not contain much less than South Bridge. On the whole, however, such uniformity as was possible in conditions that varied from hour to hour was secured, and the gross results are reliable enough for practical purposes.

"The special points noted under complexion were the pallor, the inequality of diffusion of colour, the sharpness of the margins of pink and white, the paleness of the lips and inner surface of the eyelids.

"A great many of those marked pale were not unhealthily pale. The 'pallor' of under-fed, or feeble, or diseased children, differs, as it were, in texture from the 'paleness' of health. The figures cover both; but the figures under 'health appearance' form a constant check on the nature of the 'pallor' or 'paleness.'

"(*b*) *Health Appearance.*—The special points noted here were the presence of dark rings under the eyes, the sunken character of the eyes, the sallowness, the anæmia, and other indications of feeble circulation, or bad aëration of the blood. The ruddy complexions as a rule were found also to present a healthy appearance, but not

always. In some delicate children the complexion had to be denominated ruddy.

"(c) *State of Nutrition.*—The facts of this column may be checked by the measurement of weights. The following summary brings out the relation:—

	Percentage of			Average weight in lbs.
	Stout.	Medium.	Thin.	
South Bridge, - -	23·3	52	24·6	59·7
London Street, - -	26	41	32·6	61·3
North Canongate, - -	10	51·3	38·6	56·5
Bruntsfield, - - -	31·2	45·2	23·3	63·8

"The lowest percentage of 'stouts' occurs in North Canongate, where the average weight is distinctly lowest. At Bruntsfield, the percentage of 'stouts' was highest and the percentage of 'thins' lowest, while the average weight was distinctly highest. These correlations show that the judgment of stoutness, medium nutrition, and thinness was on the whole sound. It is certain that the general impression from careful observation both of the children and of several hundreds of others not examined in detail, entirely conforms to the inferences established by the figures. Nor that only. It is impossible to convey by means of figures the quality of the stoutness and thinness in each school. For example, there was the thinness due to under-feeding, which was the predominant form at North Canongate, and there was the thinness due to high training, both muscular and nervous, which was a common feature of the other schools. The one order of thinness was associated with unhealthiness of appearance, the other was not. Thus, while in London Street the percentage of thin children (32) was slightly less than at North Canongate (38), the percentage of 'good' in appearance at London Street (45) was nearly double those at North Canongate (24), and the percentage of 'stouts' (26) was more than double (10). This clearly shows that thinness does not necessarily mean bad healthy conditions.

"The same remarks apply to paleness of complexion.

"The deficiency of 'stouts' is a better index of health conditions in the school than the presence of 'thins.'

"In South Bridge and North Canongate, the percent-

age of 'mediums' is a little over 50. In the other two schools, it is in one case over 45 and in the other 41. The least extreme distribution is found at Bruntsfield, and the general impression of the nutrition, as well as the facts regarding the weight, confirm the conclusion that at this school the children all over are better nourished. At the same time, I was impressed with the large percentage of active vigorous children at London Street. At this school the average seem to have been composed largely of very good and rather bad. They were not the result of uniformly good nutrition. This is confirmed by the fact that the number of one-roomed houses associated with this school was large, and with the other fact that the percentage of 'thins' is as great as at North Canongate.

"The correlation of the state of nutrition with the amount and kind of physical training is more complicated.

"The amount of drill in school and play out of doors was, so far as I could judge, approximately the same for each school as a whole. I watched the various playgrounds during intervals, and tried to form some conclusion from the number of idle or motionless children. But to find such a child was equally difficult in all the playgrounds. At South Bridge, the classes were not one minute in the open air before game groups were organised and actively at work. This was true of the other schools as well. Slowness of movement, quiescence, inactivity were conspicuously rare. Neither could I detect any registrable difference in the amount of noise. The playgrounds were all equally noisy. Within the schools, however, there were certain distinguishable differences. These are detailed under the heading of 'physical training.'

"(*d*) *Brightness and Alertness.*—The percentages for brightness and alertness in the individual schools exhibit no obvious relation to the nutrition. The percentage of 'goods' is greatest and the percentage of 'bads' least in Bruntsfield, where the average weight is greatest. London Street, again, shows a high percentage of 'bad,' a high percentage of 'good,' and a low percentage of 'medium.'

	Per cent. good.	Per cent. medium.	Per cent. bad.
South Bridge,	53·3	44·3	2
London Street,	59	28	12·6
North Canongate,	44	44	12
Bruntsfield,	71	27	1·3

"The estimation of brightness and alertness was somewhat difficult. I based my conclusion in each case on such circumstances as these—the readiness in answering questions, the readiness to grasp what was required of them, the quickness of motion in carrying out a request, the capacity to attend. In the last I found very great variations. One instance stands out prominently. A bright-looking girl of nine or ten, apparently appreciating everything that was done, could not be persuaded to attend seriously to anything asked of her. She seemed to be concerned with every one's business but her own. On examining her carefully, I found that she was mentally defective. Her alertness was simply readiness to be distracted with whatever happened. In another case, however, where smartness was not at first apparent, where the face was pale, where no smile lit the countenance, the tensity of attention was very great, every request was fulfilled without hurry, but perfectly and with intelligence.

"Such cases as these last were all marked good. In another case where the readiness of attention was extreme and the alertness the same, I found that the pupil was (mentally) the best in her section, and she turned out to be one of the cases of phthisis.

"(*e*) *Carriage and General Balance.*—These correspond roughly to the brightness and alertness. There were very few that one could justly call bad. The numbers recorded for each of the four schools show 86 good for South Bridge, 105 for London Street, 93 for North Canongate, and 120 for Bruntsfield."

(*b*) *From Aberdeen Report.*

"In point of health appearance, state of nutrition, and carriage and general balance, and also cleanliness, the

girls were somewhat superior to the boys, while the reverse was the case in respect of complexion. In brightness and alertness the two sexes were almost alike.

"At all ages and for both sexes taken together it was found that 14 per cent. were of 'pale' complexion; less than 1 per cent. had a 'bad' health appearance; 9 per cent. were 'thin'; only one child was marked 'bad' in regard to brightness and alertness, and none in respect of carriage and general balance.

"In less than 1 per cent. was the cleanliness of the clothing noted as 'bad,' and in only 2·5 per cent. in the case of the body. The previous notice of the examination which the parents received through the circular asking their sanction did, no doubt, help to improve the cleanliness, although the circular contained no information as to the actual day of the examination. The defective cleanliness was largely confined to the children in the Middle School; but this school, as already remarked, is attended by children from the most crowded and poorest district in the city. At the same time it is of interest to note that the children from this school were among the brightest and most alert.

"It will be observed that the proportion of pale children increased with age, from about 11 per cent. at six to nine years to 17 per cent. from twelve to fifteen years, and that the increase was much greater among girls than boys. The proportion of ruddy children was not, however, materially affected, the increment of the pale children having been drawn mainly from the 'mediums.' Possibly the confinement of school life is accountable, to some extent, for the increase of paleness.

"It is satisfactory, however, to note that the health appearance, as distinguished from mere complexion, was scarcely affected by increase of age.

"As regards state of nutrition, it was, on the whole, very satisfactory. Only 9 per cent. of the children were marked as 'thin,' and in no instance was there evidence of distinctly insufficient feeding. The state of nutrition, as judged by plumpness, diminished in boys as the age

increased. In girls, after a slight falling-off at the middle age-group, it reached its maximum in the latest age-group.

"It is of interest to remark that practically all the children examined were found to be sufficiently clothed. In some cases the clothing was poor in character, and occasionally dirty, but it was scarcely ever insufficient in quantity. Only two or three of the children were without boots or shoes. The clothing of the poorest children in the town is well attended to by certain clothing missions.

"Carriage and general balance, as judged by a natural standard, was generally good, being marked by the examiners as 'good' in 84 per cent. of the children. It was somewhat better in girls than boys at every age-group, but the difference, which was greatest at the earliest age-group, gradually diminished with increasing age. This was due, as the table shows, to an improvement in the boys rather than to a declension in the girls, and may have proceeded from a greater devotion to outdoor games. I am satisfied that although the carriage was largely marked as good, according to the standard used, it was capable of improvement under a sufficiency of suitable physical exercise and drill. This opinion is based less on the inspection of the individual child in the stimulating atmosphere of the examination room than on the general observation of the children in the playground and the streets."

2. *Cleanliness.*

The general grounds of the examination for cleanliness have already been explained (see chap. II.) The examiner should distinguish between the cleanliness due to accident and that due to neglect or bad habit. He should also take pains to ascertain what conveniences for washing exist at school. The teacher has abundant powers to secure the cleansing at least of hands and face. Any neglect of these may be referred to bad discipline. The effect of discipline, indeed, may be traced beyond the school. It is well known, especially in country schools,

that the habits of the smart and careful teacher are seen reflected in the smartness and care of his pupils. It is, however, to be remembered that cleanliness of children depends very largely on the occupation of the parents. A dirty child in a pastoral county is a much more serious indication of parental neglect than a dirty child in a colliery village or an iron-working town. If standards of cleanliness are to be of any value, all these conditions of the environment should be taken into account.

"Cleanliness of clothing and body is somewhat difficult to standardise. Of cases crawling with vermin—and there was an appreciable number of these—there could be no doubt. But of the clean skins showing many flea-bites it was more difficult to judge. Only 3·17 per cent. were marked bad for clothing, and only 8·5 per cent. for body. These, it is to be understood, were very bad. The general test of each school was not difficult to obtain:—In handling the children the examiner's hands were fouled in a much shorter time at some of the schools than at others. The largest percentage of unclean bodies and clothing was found at North Canongate. The percentage would probably have been greater than it was but for the measures taken at this school to secure cleanliness. The washing in the pond is optional, but a very large number of boys take advantage of the privilege and a smaller number of girls. The results were reflected in the children examined. The uncleanliness was not, as one might have expected, in proportion to the apparent poverty. The greatest proportion of unclean children was found among male children of six to nine. In the other schools, there were extremely few unclean children of these ages. In a great many cases, the weekly bath at home was found to be used systematically. In several cases, a daily bath was common."—(Edinburgh Report.)

3. *Comparative Estimates.*

It is impossible to make the estimate of cleanliness precise. Dirt is not easily quantified. Its presence depends on so many variable circumstances that the clean

child of this week may be the dirty child of next. Of the very few parents that complained of the examination of the child, one—a mother—gave as her reason—"My girl might have been dirty." In point of fact she was not; but the inference is obvious—had the mother been forewarned of the examination, she would have seen to the cleanliness of her child both in body and in clothing. This is one among the many good results incidental to medical inspection. In the special investigation referred to, the intention was to discover the actual condition; but as the ultimate aim of general medical inspection is prevention, forewarning of the date of examination can do nothing but good.

In comparing schools and towns, therefore, it is necessary to ascertain whether the examination had been made with or without notice. The normal mother resents the imputation of uncleanliness, and will do much to avoid it. Such sensitiveness deserves the greatest respect. The medical examiner should pass no comments in the child's hearing. It is a smaller evil that he should soil his fingers than that he should wound the feelings either of child or of parent. The unclean child has always a sad history; he is an easy and natural victim for the faults of others, but here, as in many other relations, "speech is silvern, silence is golden."

CHAPTER XII.

Examination of the Teeth.

1. *General and Immediate Causes of Dental Decay.*

Why so many bad teeth? The answers are various. Among general causes, it is suggested that a part of the widespread decay is due to incidents of advanced civilisation—overcrowding, increased nervous strain, increased proportion of cooked and soft foods. These causes are more or less speculative, and not obviously convincing. But the evidence tends to show that diet is a factor of some importance in two ways—First, where the diet has too little hard or fibrous material, there is less mastication, and, consequently, less stimulus to the teeth; second, where the diet contains much farinaceous material, there is greater formation of acid from decomposition of fragments lodged between or at the roots of the teeth. It is found that caries, or decay, appears when the mouth secretions are acid, or when acid is formed by the action of bacteria on the food. Flesh meats mechanically clean the teeth, and when the fragments decompose the products are alkaline. With farinaceous foods, the decomposition products are acid. Farinaceous foods may thus, on two grounds, become a predisposing cause of dental decay.

The immediately exciting causes are, according to the later researches, certain micro-organisms. These act as ferments on the starches and related matters of the food. The result is the production of acids. These affect the enamel of the teeth; they dissolve out the lime-salts of the enamel and the dentine, and thus achieve the destruction of the protective coverings of the pulp. The tooth is then exposed to the action of the septic micro-organisms. Septic inflammation follows. This shows itself in various forms—inflamed teeth, inflamed gums, local abscesses,

infection of neck glands, &c. Indirectly, there may result disturbances of digestion, general septic infection, nervous troubles, anæmia, general enfeeblement, &c.

These propositions—for the detailed proof we refer to special works on the teeth—are here adduced to show at once the importance of tooth-inspection and the practicability of preventive measures. The headings of Schedule A are based on the theory that dental decay is really a local infection and capable of prevention by anti-septic treatment.

2. *Importance of Inspection at School-Age.*

The importance of tooth-inspection at school-age can scarcely be exaggerated. In his excellent chapter on "Oral Hygiene," Mr. Pedley* emphasises the necessity of keeping clean the temporary, or milk-teeth, from the moment of their appearance above the gum. He asserts, and grounds his assertion in facts, that, contrary to popular prejudice, the care of the temporary teeth secures a double end: it prevents the onset of decay in the milk-teeth themselves, and prevents them from initiating decay in the permanent set. Now, at the beginning of school-age, the permanent teeth are about to emerge. If every carious tooth could be removed from the mouth of the school-child as he passes into school-life, he might start fair with his permanent set. He might be taught to bestow on his teeth the same care as he is usually taught to bestow on his face and hands. He might have his teeth watched from year to year as they appear. He might be directed to the dental surgeon when his services were necessary. Instead of being left to the merciless discipline of toothache, which is an indication of mischief already accomplished, he might be guided into preventive habits. At school-age, this is possible. Discipline then begun has every chance of securing really good results. Whatever be the ultimate causes of decay in teeth, the immedi-

* "Diseases of Children's Teeth," by R. Denison Pedley, M.R.C.S., L.D.S.Eng., &c.

ate cause is removable. On these two facts—the oncoming of the permanent teeth at school-entry age and the removability of the immediate causes of decay—rests the case for periodic inspection of teeth at school.

3. *Points for Inspection.*

(*a*) *Cleanliness.*—If dental decay be due to micro-organisms in the mouth, it follows that the first step to prevention is systematic cleansing. And cleansing means two things—general cleansing of the mouth and brushing of the teeth. The dental experts insist on cleansing after every meal. This is a counsel of perfection. But cleansing twice a day—morning and evening—is perfectly practicable and repays the trouble. Of the two cleansings, the evening cleansing is the more important; for during sleep, the microbic life of the mouth is most active, the production of decomposition is most rapid, and the cleansing action of the tongue is least.

The medical inspector should ascertain how often, if at all, the mouth is cleansed and the teeth brushed. The teacher should habitually insist on both cleansing and brushing. Preventive measures will follow the discovery of neglect.

(*b*) *Number of Teeth Present.*—This is of primary importance, both as an immediate index of soundness or unsoundness, and as a test of development. It is necessary to distinguish between the temporary, or milk, teeth and the permanent teeth. The following tables will assist in the distinction.

It has to be stated that the periods of eruption and disappearance of the temporary teeth and the periods of eruption of the permanent are only approximations. The authorities vary considerably in their averages of months and years. But the tables will form a rough guide to the medical inspector, who must, in judging of development, correlate the appearances of the teeth with the other health aspects of the child. With the earlier months of life, the medical inspector of school children is not concerned; but the sequences are given as a standard for the

estimate of delayed dentition. The school-child comes to school with his milk set of teeth complete. If he has less than 20, he must be a victim of delayed dentition or destroyed teeth.

Three tables are given. The first shows the approximate sequence of the temporary or milk teeth. The second shows the approximate sequence of the permanent teeth. The third, which is compiled from the other two, shows approximately the number of temporary and permanent teeth to be expected in normal children of the school-ages.

The numbers are not enough to enable the examiner to decide whether a given tooth is temporary or permanent. He must consider also the stage of growth in the teeth and the anatomical characters of the temporary teeth.

"The temporary Incisor and Canine teeth resemble those of the permanent set in their general form; but they are of smaller dimensions. The temporary Molar teeth present some peculiarities. The hinder of the two is much the larger; it is the largest of all the milk teeth, and is larger even than the second permanent bicuspid, which it afterwards gives place to. The first upper milk molar has only three cusps, two external and one internal; the second has four. The first lower temporary molar has four cusps, and the second five, of which in the latter case three are external. The fangs of the temporary molar resemble those of the permanent set, but they are smaller, and are more divergent from the neck of the tooth."—(Quain's "Anatomy," 9th ed., vol. ii., p. 549.)

TABLE I.

TEMPORARY OR MILK TEETH.

Number and name.	Time of eruption. in months.	Time of dropping. in years.
2—Central incisors (lower), ...	7 ...	7
2— ,, ,, (upper), ...	7-8 ...	7
2—Lateral incisors ,, ...	7-9 ...	8
2— ,, ,, (lower), ...	7-10 ...	8
4—First molars, ...	12-14 ...	9
4—Canines, ...	14-20 ...	11-12
4—Second molars, ...	18-36 ...	10
20 Total at ...	2-3 yrs. ...	12

TABLE II.

PERMANENT TEETH.

Number and name.	Time of eruption.
4—First molars,	6-7 years.
4—Central incisors,	7 ,,
4—Lateral incisors,	8 ,,
4—First bicuspids,	9 ,,
4—Second bicuspids,	10 ,,
4—Canines,	11-12 ,,
4—Second molars,	12½-14 ,,
4—Third molars,	18-25 ,,
32 Total at	18-25 years.

The third molars, or wisdom teeth, do not appear before eighteen years of age, and may be delayed till twenty-five, or later.

TABLE III.

NUMBER OF TEMPORARY AND PERMANENT TEETH IN NORMAL CHILD.

Age in years.	Temporary.	Permanent.	Total.
6-7	20	4	24
7	16	8	24
8	12	12	24
9	8	16	24
10	4	20	24
11-12	—	24	24
12-14	—	28	28
18-25	—	32	32

A study of Tables I. and II. will show which of the permanent set are to be expected at the various ages. An important point to remember is that the first permanent teeth to appear are the first molars, which precede the central incisors.

Dr. Christian Greve says:—"That the cutting of the permanent teeth may be regular, care must be taken that the milk teeth are not destroyed before their time, because inflammation and abscesses of these may injure the germ of the permanent teeth, and because by early extraction abnormalities in position may arise. When a milk tooth is removed and the permanent tooth does not quickly fill up the gap, this becomes smaller by the

approximation of the neighbouring teeth, and the permanent tooth which subsequently appears must take an inclined position, *i.e.*, forwards or backwards relatively to the alveolar arch. On the other hand, the milk teeth, or their remnants, must not remain too long in the mouth, but be removed in time to prevent similar ill-effects. The milk teeth require, therefore, good and constant supervision and treatment by a dentist just as do the permanent teeth, and we should not allow them to take their own course because they will be replaced by others."—("The Prevention of Disease," Eng. Trans. by Wilmott Evans, p. 784, art. by Dr. H. Christian Greve, of Magdeburg.)

(*c*) *Regularity or Irregularity.*—The irregularity of the teeth is of practical consequence as a predisposing cause of caries. Mr. Pedley writes:—

"Another cause depending upon the teeth themselves is due to an irregular position being assumed. From what has already been stated it will be apparent that any arrangement tending to favour the retention of food particles in the neighbourhood of the teeth will conduce to caries. So, when a tooth does not range properly side by side with its fellows in the alveolar arch, angles are necessarily formed which the tongue finds it difficult to sweep, and the *débris* collected in the recesses jeopardises not only the misplaced tooth but its innocent neighbours." —("Dis. of Child. Teeth," p. 41.)

(*d*) *Shape of Teeth.*—This includes "honey-combed" or "ridged" teeth, where the enamel is defective; Hutchinsonian or syphilitic teeth—of the "screw-driver" type, or chisel-shaped, or crescentically notched or peg-shaped, the teeth being often short and narrow; twin teeth, due to union during growth, and other irregularities.—(See Pedley, *op. cit.*, ch. 6; Hutchinson, "Syphilis," Cassell & Company, p. 328.)

(*e*) *Number of Decaying Teeth in First and Second Sets.*—As already indicated, decay in the first set is not to be lightly regarded. It may lead to infection of the permanent set. It is important to record the numbers affected.

(*f*) *Number of Second Set Lost.*—This is a matter of great practical importance. On the number lost may depend the eligibility of the child for future service in army or navy. Where the number lost is large, it may be assumed that there has been some special constitutional disease, or some special injury, as from medicines, or unsatisfactory feeding, or great neglect.

"The late war has drawn attention to the numerous rejections of otherwise fit recruits, both in army and navy, owing to defective teeth. A recruit must have ten sound teeth in either jaw to be eligible for enlistment."—(G. W. Watson, L.D.S., "Encyc. Med.," Green & Sons; art. *Teeth.*)

4. *Results of Edinburgh and Aberdeen Investigations.*

(*a*) *From Edinburgh Report.*

"More than a fourth of the children were recorded as having unclean teeth. Only 5 per cent. used a tooth-brush daily. Some 7 per cent. showed delayed development of the teeth. The teeth of 67 per cent. were regular, and only 5½ per cent. showed irregularity. In 6 per cent. of cases the shape of the teeth was bad. In 571 cases out of 591 examined were found some decayed teeth of the first set. The average number of first-set teeth so found decayed was 4·95. In 110 cases the second set showed decayed teeth, the average number of such teeth being 2·51. A considerable number showed defective teeth of both sets. The average number of the second set lost was 0·68."

(*b*) *From Aberdeen Report.*

"The cleanliness of the teeth was not satisfactory, only one-third of the children being marked as good in this respect. Not more than 12 per cent. brushed their teeth daily, and these belonged almost entirely to the better classes of the population. The attention to brushing increased only slightly with increasing age, and was somewhat greater among girls than among boys.

"Only 3 per cent. showed distinctly irregular teeth,

and only 5 per cent. had ill-shaped teeth. In one of these the teeth had the shape characteristic of congenital syphilis, and the same child suffered from choroido-retinitis of the eyes.

"The development of the permanent teeth was delayed in nearly one-fifth of the children, and distinctly more largely in boys than girls, and the delay was more frequent at the later than the earlier ages.

"The number of the permanent teeth in each child was counted, and the average for each yearly age and each sex is given in a separate table. The averages agree with the usual statements in works on anatomy, except that after the age of eight years the development in the Aberdeen children was half a year to fully one year behind.

"Decay of the permanent teeth was present in fully one-third of the children of the lowest age-group (six to nine years), and had apparently begun in most of these almost with the first appearance of the permanent teeth. The last year (eight to nine) of this age-group witnessed a larger addition to the children with decayed teeth than any subsequent year. By the age of ten or eleven the proportion of children with decayed teeth had risen to nearly four-fifths; but it did not show a material increase at the later ages. The proneness to decay of teeth was, therefore, of early origin. Decay of the permanent teeth was usually associated with decay of the first set. Probably the early removal of decayed teeth among the first set would assist greatly in preventing decay of the second set.

"The average number of decaying permanent teeth per child was a little over 2 in the first age-group, and increased to about $3\frac{1}{2}$ in the highest age-group. The greater part of the increase in the last group was due to a sudden rise in the last year (fourteen to fifteen) of the group. The rise took place in both sexes."

The following table from the Aberdeen report is of value for comparison with the standard tables already given:—

AVERAGE NO. OF PERMANENT TEETH PER CHILD AT EACH YEAR OF AGE.

Age.	Sex.	Above 6 & under 7.	Under 8.	Under 9.	Under 10.	Under 11.
No. of Children	M.	32	33	34	33	34
	F.	34	34	33	34	33
Average No. of Teeth per Child	M.	4·2	8·0	10·3	13·6	15·8
	F.	5·0	8·0	10·0	14·0	16·4
	Both Sexes	4·6	8·0	10·1	13·8	16·1

Age.	Sex.	Under 12.	Under 13.	Under 14.	Under 15.
No. of Children	M.	33	35	34	32
	F.	33	33	34	32
Average No. of Teeth per Child	M.	20·0	23·3	24·8	27·0
	F.	20·0	24·1	26·6	27·8
	Both Sexes	20·0	23·7	25·7	27·4

5. *Tooth-Inspection and Tooth-Cleansing Drill.*

These facts and considerations indicate that the teeth of all school children should be subject to periodic inspection. Doubtless, a great deal of evil will have resulted from neglect in the pre-school life of the child; but this should not preclude some effort to forestall the greater evil to come.

"Tooth-cleansing Drill" will strike the conventional person as a preposterous and ridiculous extension of "medical faddism." But this opinion leaves us quite unmoved. We can always silence it by a single question—Is it more preposterous or more ridiculous to teach our children how to preserve their teeth than to reject tens of thousands of good army and navy recruits because they cannot munch hard biscuits with the teeth left to them? Is it more preposterous to spend nothing but a little common sense in teaching the use of the tooth-brush than to spend hundreds of thousands in providing our soldiers

with false teeth? In the school-age and at school, it is possible to lessen the losses of teeth. In the recruiting age, the teeth are already lost. An army marches on its teeth. Surely, therefore, it is the lowest depth of ineptitude to scoff at the tooth-brush drill and yet to lament the big percentage of rejections. If it be true that the decay of teeth can be arrested—and it is true; if it be true that the orders whence recruits are drawn have no chance of learning how to clean their teeth unless they learn at school; it follows that tooth-inspection and tooth-brush drill are as appropriate to the school-age as washing of hands and faces. And there are so many drills at the elementary school—needle-drill, free-arm drawing, free gymnastics, endless variations with dumb-bells, bar-bells, parallel bars, and the trapeze. Under direction, they are all excellent; but none of them exceeds in ultimate value the drill that shall preserve the teeth from decay. Muscles are of little use if they cannot be fed. It seems to us, as we contemplate the grim issues to the individual and the community, that clean teeth are as important as clean ears or clean faces. And if teeth ought to be clean, we find nothing absurd in systematic discipline to secure their cleanliness. Every well-bred child in the upper and middle classes is taught to use the tooth-brush as soon as his faculties are equal to the task.

There are many ways of organising tooth-cleansing drill. At present the school organisations provide their children with dumb-bells, bar-bells, needles and thimbles, pens, pencils, and many other minor school appliances. They sell books or give them free. It would be difficult to show why tooth-brushes should not come into line with these. The school outfit ought to include a tooth-brush. The teacher ought to see that it is used. In the small classes now common in the state schools, this additional responsibility would be scarcely perceived—so easily may it be discharged.

Where tooth-brushes are provided, they should be carefully scrutinised and cleansed from time to time. Nothing is easier. The brushes can be boiled occasionally. They

can be kept in carefully-cleaned vessels. They should be under the charge of some person intelligent enough to appreciate the importance of sterilisation. This is one of many matters that may properly be referred to the advice of a medical inspector of schools or a medical officer of health.

CHAPTER XIII.

Examination of Nose and Throat.

1. *Importance of Nasal Respiration.*

Normally, a child breathes through the nose. The passages are narrow. They are lined with highly vascular membranes. They expose to the ingoing air a large surface, and warm it as it passes through. Dr. Greville Macdonald says—"Indeed, roughly speaking, it may be asserted that, however cold the external atmosphere, the inspired current of air is raised to the temperature of the blood before reaching the pharynx."—("Encyclop. Med.," art. *Post-nasal Adenoid Growths*, also, "On the Respiratory Functions of the Nose," 1889, p. 25.) The air, thus warmed to the correct temperature, causes less re-action on the delicate lining of the bronchi. As it penetrates further into the tubes, it gathers more heat, and by the time it reaches the air-vesicles of the lungs it is warm enough neither to cool nor to heat the lung-tissue. This is easily verified. "The temperature of expired air is variable, but under ordinary circumstances is higher than that of the inspired air. At an average temperature of the atmosphere, for instance, at about 20° C., the temperature of expired air is, in the mouth 33·9° C., in the nose 35·3° C. When the external temperature is low, that of the expired air sinks somewhat, but not to any great extent, thus at 6·3° C. it is 29·8° C. When the external temperature is high, the expired air may become cooler than the inspired, thus at 41·9° it has been found to be 38·1°. The expired air takes its temperature from that

of the body, that is, of the blood, and this, as we shall see later on, while generally higher may, at times, be lower than that of the atmosphere. The exact temperature of the expired air, in fact, depends on the relative temperature of the blood and inspired air, and on the depth and rate of breathing. The change in temperature takes place not in the lungs, but in the upper passages, and chiefly in the nose and pharynx."—(Foster: "Text-book of Physiology," 5th ed., p. 550.)

This is a cardinal fact in physiology. One practical deduction is obvious: If nasal breathing is obstructed, the linings of the nose will suffer because they are not rhythmically cooled; the lungs will suffer, because they are exposed to unwarmed air. In the nose, there may arise a tendency to overgrowth of tissues; in the lungs, there will be a tendency to catarrh. And there is a further consequence: It is found that, even when the nasal respiration is obstructed, children still, during sleep at least, persist in breathing through the nose.—(Macdonald, *op. cit.*) The result is imperfect respiration and, it may be, a deformed chest—"pigeon-chest." When the child grows older, he acquires the habit of mouth-breathing. This improves his respiration, but it exposes the lungs to greater danger, and he will have already suffered in nutrition and growth.

From these primary facts, it is clear that the examination of the nose and throat must constitute an essential part of every medical inspection of school children. This is confirmed by very extended experience. Every school, every dispensary, every hospital, every institution where children are available for examination, can produce an enormous percentage of children that show some degree of nasal obstruction. And overwhelming experience further shows that where the obstruction is removed the child improves both physically and mentally.

2. *Varieties of Nasal Obstruction.*

Nasal obstruction, in one degree or another, results from almost all nasal diseases. Of these the most impor-

tant are the following:—Nasal eczema due to discharges; thickening or malformations of the septum; abscesses; hypertrophy of erectile tissue; polypus; acute inflammation (rhinitis), otherwise named "acute nasal catarrh," "coryza," "cold in the head"; chronic inflammation, accompanied by hypertrophy of lining membranes; ozaena (atrophic rhinitis); chronic infective diseases—syphilis, tuberculosis, lupus being commonest in this country; post-nasal adenoid growths, which are extremely common among all classes of children.

Many of these diseases are inter-related. Acute nasal catarrh is the most frequent. It is the result of many conditions. By itself, it is not serious; but when it recurs persistently, it may be an indication at once of unsatisfactory constitutional tone and of local obstructions or hypertrophies. "Chronic coryza in older children is generally associated with adenoid vegetations and enlarged tonsils. There is usually no localised hypertrophy, but much general swelling, also often eczema of the vestibules. It frequently occurs with congenital syphilis."—("Encyc. Med.," art. *Nose: Chronic Inflammation*, by Dr. E. Cresswell Baber.)

3. *Adenoids and Enlarged Tonsils.*

(*a*) *Nature and Appearance.*—"Adenoid (gland-like) vegetations," or briefly "adenoids," is the name given to over-growths of the lymphoid tissue in the naso-pharyngeal space. Lymphoid tissue, which is essentially of the same character in tonsils, lymph-glands, spleen, &c., is one of the constituents of the nasal lining. Any over-growth of it in the post-nasal region acts as an obstruction to nasal respiration. These over-growths form little soft masses capable of being distinguished by a finger inserted behind the soft palate. They may vary in size from a minute patch to bodies that, in the aggregate, may entirely block the posterior nasal passages.

(*b*) *Causation.*—On the causation of adenoids, pathologists are not unanimous. It is suggested that the V-shaped alveolar arch of the upper jaw, the strumous (or scrofulous)

diathesis, are predisposing causes. "Enlarged cervical glands are almost invariably present in cases of adenoids." —(Macdonald.) Sims Woodhead maintains that adenoids constitute a *nidus* for tubercle bacilli. They can scarcely be regarded as by themselves an evidence of tubercular predisposition, but they increase the possibilities of tubercular infection. But whatever be the truth as to predisposition, adenoids may follow acute diseases—influenza, measles, whooping-cough. Macdonald suggests that the prevalence of these diseases cannot be dissociated from the prevalence of adenoids. But the question arises—At what point does the over-growth of the lymphoid tissue become pathological? "It may even become a question as to whether the growths in themselves can be pronounced as morbid, and whether they have any importance beyond the mechanical obstruction. Such, at any rate, is the present tendency of belief, although some observers appear to consider the adenoids as a direct invitation to the contraction of catarrhs in general, whether nasal, bronchial, or gastric. My own inclination is to regard the common symptom of excessive-cold-taking as due to the obstruction, seeing that we find the same tendency in every form of nasal stenosis, whether polypus, enlarged inferior turbinals, or mere deviations of the septum. And we may state that it is the restoration of the normal conditions of ventilation which is responsible for the cure of the tendency to take cold in all cases of nasal obstruction."—(Macdonald, *op. cit.*) He also suggests that the overheating of the tissues in narrow nasal passages "may cause hypertrophy of the lymphoid tissue." Any obstruction or narrowing of the anterior nasal openings may cause congestion of the membranes lining the posterior passages; hence increased growth of tissue.

(*c*) *Signs and Symptoms.*—As a rule, adenoids begin in the pre-school age. By the time the child comes to school, he has already acquired the habit of mouth-breathing. He breathes through his nose only with effort, if at all. He goes with gaping mouth. He usually has narrow nasal openings. The bridge of his nose is broadened. He has

a stupid expression. He has difficulty in articulation. His voice is thick. "Obstruction in the naso-pharynx destroys all nasal resonance, rendering the voice 'dead,' turning the consonants *m* and *n* into *b* and *d* respectively. When growths obstruct the posterior nares, but do not project into the naso-pharynx, a certain resonance of the voice remains, as pointed out by W. Meyer."—("Encyc. Med.," Dr. E. Cresswell Baber, art. *Examination of Nose.*) The child suffers from headaches. He is backward for his age. He shows no power of application. He cannot concentrate his attention. He may be deficient in smell, in taste, and in hearing. He will probably show "pigeon-chest." He suffers in general nutrition and development. He loses in every race. To the looker-on, he is the victim of "standing bad luck."

The type here detailed is not unfrequently realised. But lesser degrees of the affliction are to be reckoned in multitudes. Hence the importance of inspection, supervision, and treatment.

(*d*) *Enlarged Tonsils.*—The child that suffers from adenoids usually suffers also from enlarged tonsils; but these may occur alone. Enlarged tonsils occur in a very large percentage of children. The process of enlargement begins very early. It may follow on repeated attacks of tonsilitis (or acute inflammation). But it may occur in certain constitutions (*e.g.*, the strumous or the rheumatic) without any apparent exciting cause. Like adenoids, the enlarged tonsil is an over-growth of tissue normally present. Like adenoids, they obstruct respiration. They result in partial deafness, because they may obstruct the Eustachian tube, or because the repeated inflammations may affect tonsils and tube alike. Nor this only. The tonsils are exposed to infections from mouth and nose. They are the typical starting-point of diphtheria and scarlet fever. They are frequently the seat of specific infections—suppurative, catarrhal, ulcerative.

As with adenoids, so with enlarged tonsils; their removal is usually the beginning of a new era in the health-progress of the child.

4. *Other Diseases of Throat—Methods of Examination.*

There are many other diseases of the throat and nose. But we have focussed attention on those that predominate among school children. The methods of examination can never be applied exhaustively at school, but they can be pushed far enough to enable the medical inspector to decide whether an individual child should continue without treatment, or should be sent for operation, or requires removal to more hygienic environment. Nose, throat, and ear are intimately correlated. The examination of each should be supplemented by the examination of all. It is the business of the medical inspector to indicate the conditions that, in the interests of the child's efficiency, demand immediate treatment and future supervision.

In the Edinburgh and Aberdeen investigations, the examinations were made, not with the object of eliminating or treating those affected, but with the object of ascertaining the proportion of affections.

"The nose and throat were examined as thoroughly as was possible without the aid of instruments, beyond a simple spatula. An attempt was made at first to use the nasal speculum and rhinoscopic mirror, but the children did not readily tolerate the use of these instruments, which were, therefore, abandoned. Consequently, some diseases may have escaped recognition, such as polypus and hypertrophy of turbinated bones."—(Conjoint Report.)

5. *Sense of Smell.*

In the Edinburgh and Aberdeen investigations, the sense of smell was also examined.

"The sense of smell was tested by a distilled solution of oil of peppermint of three different strengths—viz., 1 in 1000, 1 in 10,000 and 1 in 100,000. A control test of simple water was also used. The weakest of the peppermint solutions represented the limit of dilution detectable by a person with normal sense of smell. Children are classified in the table as defective in sense of smell if they

failed to recognise one or all of the peppermint solutions. The number of failures were so few that it has been considered unnecessary to grade them."—(R.C.P.T.S., i., p. 75.)

6. *Results in Edinburgh and Aberdeen Investigations.*

Among the Edinburgh children examined, adenoids or enlarged tonsils or both were found in about 52 per cent. Among Aberdeen children, 30 per cent. showed throat or nose affections—adenoids, enlarged tonsils, and granular pharyngitis (which was not classified in Edinburgh). The great differences between the children of the two cities are probably due in part to differences of social grade in the children examined, in part to the "personal equation" of the examiners, in part to differences of heredity, in part to differences of local climate. Of the four Edinburgh schools, it is to be noted that Bruntsfield showed the smallest number of children affected with combined adenoids and enlarged tonsils, and also the smallest number affected with adenoids alone. But the difference was not strikingly great. This seems to indicate that housing and nutrition stand in very complicated relation to adenoids and tonsils.

"*Enlarged Tonsils.*—The number of children suffering from enlarged tonsils alone, that is, uncombined with adenoids, was 147. Of these, 71 were found in South Bridge School, 27 in London Street, 22 in North Canongate, and 27 in Bruntsfield. The distribution between boys and girls was fairly equal, the girls showing a slight preponderance, which was maintained in all the schools except Bruntsfield. In South Bridge, 40 girls were affected, as against 31 boys; in London Street, 14 girls, as against 13 boys; in North Canongate, 13 girls, as against 9 boys; and in Bruntsfield, 10 girls, as against 17 boys.

"*Enlarged Tonsils and Adenoids.*—Here, too, there is a slight preponderance among the girls, but only at the six to nine and nine to twelve age-groups. The numbers for the individual schools were—South Bridge, 20 girls, 20 boys; London Street, 10 girls, 9 boys; North Canongate, 19 girls, 17 boys; Bruntsfield, 10 girls, 6 boys.

"*Adenoids alone.*—Here there is a slight preponderance among boys.

"If enlarged tonsils and adenoids be taken together, it is found that the school showing most cases was South Bridge, 115; next North Canongate, 80; next London Street, 65; next Bruntsfield, 53. Probably South Bridge suffers to some extent in the comparison from the fact, noted elsewhere, that it stood first in the series; but as the same examiner dealt with all throats, and as care was taken that the standard should be kept as uniform as possible, the 'personal equation' cannot count for much. All enlargements, slight or great, were noted.

"Tonsils and adenoids, singly or in combination, are of the first importance in relation to physical development. They are a decisive indication of the importance of discipline in breathing. No special note was taken of mouth-breathers, but, from a general impression, I concluded that the number was very large. From the standpoint of physical training, the mouth-breathers, that is, practically all those affected with adenoids, and most of those affected with enlarged tonsils, ought to be specially classified and specially disciplined in correct habits of breathing. In many of the cases operation was indicated."—(Edinburgh Report.)

"One-fourth to one-third of all the children examined were suffering from some affection of the throat or nose, but it was in the majority of cases very slight, and scarcely requiring medical treatment. About one-fifth to one-fourth of the children suffering from enlarged tonsils or adenoids—that is, about one in twenty of all the children examined—would probably have benefited by surgical treatment. The affections of the throat were more numerous in the older than in the younger children, but the increase was slight and immaterial. More girls than boys were affected, and the disparity was more evident at the later than the earlier ages. The few unclassified cases of disease were suffering from inflammation of the nose, follicular tonsilitis, inflammation of the throat, or wart on tongue.

"Only three children were found to have a defective sense of smell, and in each case the sense was not completely lost. All three were suffering from catarrh."—(Aberdeen Report.)

7. *Respiration Drill.*

Every school affords innumerable occasions for respiration drill. This has two aims—to discover and eliminate the mouth-breather; to secure the proper development of the chest. Both aims may be well forwarded at every in-taking of the children from the playground.

In the larger schools, it is the custom to marshal the children in the playground, then to march them into the school to the rhythm of music or hand-clapping. It would be a matter of seconds for the teacher to discover all the mouth-breathers, and to submit them for special examination and treatment. Meanwhile, as a matter of routine, he should, before uttering the order "march," exact from the ranks of children three or four deep breaths with mouths shut. In season and out of season, in school and out of school, he should insist on breathing through the nose. But he should not be satisfied with this alone, for we have seen that nasal breathing through an obstructed nose is, although harmful, still, in many cases, practised. He should, therefore, ascertain whether the respirations are full and deep, whether the chest expands properly, whether the effort of nasal breathing is too great. If he discovers a child whose breathing by nose is laboured, he should mark him for examination. If he finds a child whose nasal breathing is easy, yet whose mouth is habitually open, he should mark him also for medical examination before subjecting him to disciplinary drill. With the normal, or slightly abnormal children, he will have no difficulty. He will be able to impose on them the habit of nasal breathing. He will have his reward in the lessened number of "colds in the head," in the improved expansion of the chests, in the greater vigour and lustiness that follow.

Respiration drill should not end here. The children

should be taught to fill their chests without effort. They should be drilled in deep breathing with hands over head. They should, when rickety or deformed, receive special and extended drill in the methods of overcoming the bad results of their deformity. All drill pre-supposes respiration drill, but respiration drill should be the beginning and the end; it should be the primary drill for all children. It should be systematic, frequent, gentle, thorough. It should vary in amount to meet each capacity. It should vary in kind to meet deformities in the chest or deficiencies in the lung. It should be tested by its effects on the chest, on the carriage, on the circulation, on the general nutrition. It should cease to be merely an incident of gymnastic training; it should become a conscious and persistent discipline until deep breathing becomes an ineradicable habit.

CHAPTER XIV.

Examination of Ears and Hearing.

1. *Methods of Testing.*

It is not here intended to describe exhaustively the methods of ascertaining defects in hearing. In the Edinburgh and Aberdeen investigations, the watch test was employed. It was checked by the voice test. The aim was not so much to determine the precise amount of the defect as to ascertain whether the defect really interfered with the school-efficiency of the child. Dr. Kerr estimates that in 5 to 10 per cent. of children defects of hearing interfere with school progress. Any method employed should bear directly on the defects as viewed from this standpoint.

(*a*) *Watch Test.*—To apply the watch test proceed as follows:—

(1) Procure a watch that ticks distinctly and loudly enough to be heard by a normal ear at a distance of ten feet or thereby. The actual distance is immaterial. It should be precisely ascertained by experiment on a considerable number of persons known, on other grounds, to possess normal hearing. In standardising the watch, it is important to remember that the hearing distance varies with the local conditions. If the watch is near a wall, the sound is intensified for the hearer. If the experiment is made in a narrow passage, the sound is conducted to a greater distance. Similarly, currents of air are apt to interfere. When, however, the hearing distance for normal ears is ascertained, let this be called the normal.

(2) Select the quietest room in the school. Mark on the floor a space about one foot square for the child to stand in. From this space draw a line on the floor to a distance of some twelve or fifteen feet. Divide this line into feet, half-feet, and quarter-feet. If more delicate testing is required, the line may be divided into inches. But for school purposes this is not necessary.

(3) Let the child first hear the tick of the watch held quite close to the ear. Direct him to shut his eyes. When the left ear is being tested, it is well either to plug the right ear with a little cotton wool or to have it covered with the hand.

(4) Then hold the watch at the extreme distance of the line. Bring it nearer and nearer until the tick is heard. Carry it further away and nearer two or three times until you are satisfied that the replies of the child are not random replies. Stop the watch by touching the balance-wheel, or put it behind the body so that the sound is muffled. With children this unexpected stop of the watch is important.

(5) To record the observation, make the "normal" distance of the watch the denominator and the actual distance at which it is heard the numerator of a fraction. Thus, if the watch is heard at an average distance of five feet and the normal distance for this watch is ten feet, the observation recorded would be $H = \frac{5}{10}$. The same method should be followed if the record is taken in inches.

Thus, if a watch, whose normal distance is thirty inches, is heard only at five inches, then $H = \frac{5}{30}$. Dr. Logan Turner suggests—"If the watch be heard only on contact or on pressure upon the skull, it may be expressed as P/30, while if the tick is not perceived at all it may be registered as 0/30."—("Encyclopædia Medica," art. *Ear.*)

(6) Then proceed in the same way with the other ear.

(*b*) *Voice Test.*—Dr. Arthur H. Cheatle says—"In conducting the examination each child was placed eighteen feet away and simple questions in a quiet whisper were asked—(1) With both ears unclosed and the eyes shut; and (2) with one unclosed ear first turned to me and then

the other. After the result was noted, the ears, nose, pharynx, and, in a large number, the naso-pharynx, were examined.

"If necessary, tuning fork tests were applied, but in all the middle-ear cases, Politzerisation was employed in order that the diagnosis might be strengthened by the improvement obtained.

"A distance of eighteen feet was used, as it was found to be a convenient one in the first room in which the examination took place and was, therefore, employed all through.

"The test erred on the side of leniency, but formed a good working standard. The whispered voice test is often deceptive to the examiner, but in nervous, stupid, or very young children, it is the only one possible; a positive result can usually be obtained, and is less deceptive than a child's answer to the watch. Examination of the naso-pharynx for adenoids was made in all children in whom the ears were affected, and those in whom from any appearance or symptom they might be suspected."—("Report of an Examination of the Ears of 1000 school children, &c.," by Arthur H. Cheatle, F.R.C.S.)

Dr. Logan Turner states that—"In children it is often difficult and, in the very young, even impossible, to obtain satisfactory answers either to the watch or voice tests. In the majority of cases, the former is quite unreliable. It may sometimes suit all practical purposes to ask a few simple questions in ordinary tones and note whether they are responded to."—(*Op. cit.*, art. *Ear.*)

In the Edinburgh and Aberdeen investigations the following method was adopted:—

The hearing power of each ear was separately tested, by means of a watch audible to a person of normal hearing in a still room at a distance of about nine feet.

Similar watches, which had been previously compared, were used in the two cities. This test is not altogether reliable in distinguishing the finer grades of defective hearing, especially in young children, but it is sufficiently useful for practical purposes. Where the hearing power

of the two ears differed, the average has been used in making up the table. If the average distance at which the watch was heard was less than four feet, the hearing has been classed as "distinctly defective"; if between four feet and eight feet, "defective"; and if eight feet and upwards, "normal." It may be assumed that a large majority of the children marked as "defective" would, nevertheless, have no difficulty in following the work of the class. All those entered as "distinctly defective" would have a decided difficulty. Defective hearing is usually due to disease of the ear or throat, or a combination of both. The causes of the defective hearing in the children examined have therefore been classified in reference to diseases of these parts.

The drum of each ear was examined with a speculum.—(Rep. R.C.P.T.S., p. 75.)

2. *Examination of the Ear.*

The hearing test should be immediately followed by the detailed examination of the ear by the speculum. It is the most important part of the examination. A well-lighted room, or a properly-lit lamp, is essential.

In a great many school children, wax will be found to obscure the view of the tympanic membrane. For a thorough examination, this ought to be removed, but this is rather a matter for the ear surgeon than for the school inspector. If the amount of wax is sufficient to cause deafness, the child should be referred to an aural specialist for further examination.

For the technique of the examination and the details of the appearances to be found, we must refer to special works on the ear. The details quoted below will indicate sufficiently the varieties of disease to be expected.

(*a*) *From Edinburgh Report.*

"(1) *Number Examined.*—In this table the number examined is given as 597. The deficiency is due to the absence of three cases at the time fixed for examination of

ears. This number, however, is too small to affect averages.

"(2) *Keenness of Hearing.*—From the conditions of the schools, the watch test of keenness of hearing was not particularly reliable. It was extremely difficult to find a room suitable at once for the watch test and for the speculum examination of the ears. The diffused noises of the school, the varying noises of the street, the periodic flooding of the playgrounds with noisy children, all contributed to reduce the value of the test. And with the younger children, there was another disturbing factor—suggestion. They answered 'yes' or 'no' largely according to their belief as to what was expected of them. With care and time, this might have been eliminated in every case; but even with the older children, it was extremely difficult to make certain that the sound supposed to be heard was not a suggested sound. In several instances, I tested the hearing afterwards by speaking in a very low voice. In most cases, this confirmed the results got by the watch, but the cases thus verified were too few to constitute a real check.

"On the other hand, the 'distinctly defective' children are probably all as defective as the watch test indicates. By many of them the watch could be heard only on contact, or at a distance of a few inches or one foot. In all such cases a minute examination of each ear was made, and, except in one case—where the internal ear was affected—some definite defect of the middle ear was discovered. The watch test was thus of value less for testing the minute discrimination of distances than for the revelation of major defects. But it has to be remembered that children at school are accustomed to pick out sounds from a diffused matrix of irrelevant sounds, and this must be counted in favour of the watch test results.

"The percentage of 'distinctly defective' children was 6·70; of 'defective,' 35·24; of 'normal,' 57·96.

"Among males the percentage of 'defective' and 'distinctly defective' taken together was 38·5; among females, 45·63; both sexes, 42·04. The highest percentage

—55—was found among females of nine to twelve; the lowest—34—among males of twelve to fifteen. The females of all three age-groups show a greater number of 'defectives' and 'slightly defectives.'

"This result is confirmed by the figures in the 'disease' columns. If we take all the 'diseases,' including 'cerumen,' and including also the diseases of the throat, we find that, among females, the number was 294; among males, 259; excess for females, 35. If we deduct cerumen, the numbers become—for females, 221; for males, 189. If we confine ourselves to the specific ear diseases, the numbers become—for females, 115; for males, 100; excess for females, 15." *

3. *Special Ear Diseases.*

"(*A*) *Otitis Media and Perforation.*—This column probably does not include all the cases of perforation with inflammatory discharge; it should be read along with the column headed 'dry perforation' and 'chronic catarrh.' These three columns, along with the column 'cicatrices,' fairly represent the amount of middle ear and tympanic disease." Of otitis media and perforation, there were 15 cases—6 males, 9 females; of dry perforation, 8 cases—3 males, 5 females; of chronic catarrh, 13 cases—4 males, 9 females; of cicatrices, 10 cases—4 males, 6 females.

"(*B*) *Retracted Membrana Tympani.*—In many cases, the retraction was very slight, in others it was very well marked, in every case of the 169, except 20, it was associated with enlarged tonsils, or with adenoids, or with both. Retraction of the membrane signifies closing of the Eustachian tube, which was not specifically ascertained in each case.

"For the particular schools the facts are as follows:—

"(*a*) *South Bridge.*—Cases of retracted membrane, 52;

* Note that this paragraph refers to diseases, not to individual children. For females, the 294 diseases were distributed among 130 children only; for males, the 259 diseases were distributed among 106 children only. And this includes "cerumen." In 89 males and in 106 females both throat and ears were affected.

total enlarged tonsils or enlarged tonsils with adenoids, 115.

"(*b*) *North Canongate.*—Retracted membrane, 53; enlarged tonsils or tonsils with adenoids, 80.

"(*c*) *London Street.*—Retracted membrane, 36; enlarged tonsils or tonsils with adenoids, 65.

"(*d*) *Bruntsfield.*—Retracted membrane, 28; enlarged tonsils or tonsils with adenoids, 53.

"The very large number of enlarged tonsils in South Bridge School is probably in part due to the fact that South Bridge was examined first. The standard applied was naturally more exacting. In respect to the diseases of the ears, South Bridge runs practically parallel with North Canongate, both having a higher total of ear diseases than either London Street or Bruntsfield. Probably, on a careful comparison, case for case, the state of the throats would also be more nearly equal.

"(*C*) *Cerumen.*—Cerumen (wax) was found in excess in 143 instances. Sometimes the quantity produced impaction of the tympanum, with distinct deafness. Very frequently the cerumen obscured the tympanum. Except in the impacted cases, cerumen cannot be designated a disease, but its presence in excess is evidence of inattention to the ears, or of injudicious moistening, or of general neglect of cleanliness. For the individual schools the cases were—South Bridge, 47; London Street, 29; North Canongate, 46; Bruntsfield, 21."

(*b*) *From Aberdeen Report.*

"The results as regards hearing were good, only five children having 'distinctly defective' hearing, such as would interfere with the proper progress of their school work. In no case was there complete deafness. The proportion of children with 'defective' as distinguished from 'distinctly defective' was 13 per cent., and the cases were irregularly distributed over the age-periods. There was a preponderance of the cases among girls.

"The defective hearing was in many instances remediable, or capable of improvement, under suitable medical

treatment. Some of the severest cases, such as those of otitis media (inflammation of the middle ear), were receiving no treatment; others were apparently being properly attended to. The attention of the teachers was directed to the cases which were in particular need of medical assistance.

"The children marked as suffering from cerumen or wax in the ears include only such children as had sufficient cerumen to produce impaction or interfere with hearing.

"In keenness of hearing, 86·2 per cent. were normal, 13·0 per cent. defective, 0·8 per cent. distinctly defective. These percentages are very much less than those of the Edinburgh children. Similarly, the percentages with adenoids, or enlarged, or both, were different."

(c) *From Dr. Cheatle's Report.*

Dr. Cheatle's results in the Hanwell District Schools more nearly correspond with Edinburgh.

"The hearing was more or less deficient in 520; that is to say, that with one or both ears they were unable to pass the whispered voice test at eighteen feet. Many of these were unnoticed by the teachers, the deficiency only being noticed on examination."

In Hanwell District Schools the "whisper-voice" defectives were 52 per cent., as against Edinburgh "watch test" defectives, 42 per cent. In Hanwell, the ears were normal in 43·2 per cent.; the external ear was affected in 49 per cent.; the middle ear, in 51·8 per cent.; the internal ear, in 0·1 per cent.

As an admirable illustration of special inspection of ears, we reproduce the following table from Dr. Cheatle's Report. For the further analysis of detail, we refer to the Report itself. It is a model for all school examinations of the ear.

"The following table is introduced to compare the Main School which receives children from the City of London and Southwark only, with the Ophthalmic which receives them from *all* the Metropolitan Poor Law Schools. On the whole the tables correspond, the most marked differences

being seen in the *depressed membranes* and *post-suppurative* tables. Those described as *normal* are nearly identical:—

		Ophthalmic School.			Main School.			Total Ophthalmic and Main.	
		Male.	Female.	Total.	Male.	Female.	Total.		
1.	Normal ears and hearing, ..	64	54	118	126	97	223	341	
2.	,, ears with enlarged tonsils and adenoids, ...	6	5	11	10	8	18	29	
3	,, ears with adenoids, ..	1	5	6	2	3	5	11	
4.	,, ears with enlarged tonsils, ...	13	7	20	16	13	29	49	
5.	,, ears with abnormal band in post-nasal space, ...	—	—	0	1	—	1	1	
6.	Abnormality of the auricle, ..	1	—	1	2	—	2	3	
7.	Foreign body in the ear, ...		2	3	6	9	15	18	
	Less		1	1	3	5	8	9	
		1	—1	—2	—3	—4	—7	—9	
8.	,, ,, in the nose, rhinolith, ...	—	—	0	1	—	1	1	
9.	Cerumen, ...	12	10	22	3	8	11	33	
10.	Furunculosis, ...	—	—	0	—	2	2	2	
11.	Eczema of auricle, ...	—	—	0	1	1	2	2	
12.	Hæmorrhages in membrane with adenoids, ...	—	—	0	1	—	1	1	
13.	? Congenital perforation in Shrapnell's membrane, ..	1	—	1	6	1	7	8	
14.	Acute middle ear inflammation,	—	—	0	1	1	2	2	
15.	Depressed membranes and deafness, with enlarged tonsils and adenoids, ...	3	8	11	26	27	53	64	
16.	,, ,, with adenoids,	11	12	23	36	18	54	77	166
17.	,, ,, no enlarged tonsils nor adenoids, ...	7	1	8	9	8	17	25	
18.	Middle ear Sclerosis, ...	—	1	1	—	5	5	6	
19.	Chronic middle ear suppuration with enlarged tonsils and adenoids, ...	3	2	5	7	8	15	20	
20.	,, ,, with adenoids,	4	9	13	19	19	38	51	
21.	,, ,, with enlarged tonsils, no adenoids, ...	—	—	0	—	1	1	1	88
22.	,, ,, no enlarged tonsils nor adenoids, ...	5	3	8	6	2	8	16	
23.	Post-suppurative middle ear trouble with enlarged tonsils and adenoids, ...	2	4	6	21	28	49	55	
24.	,, ,, with adenoids.	10	13	23	56	37	93	116	
25.	,, ,, with enlarged tonsils, no adenoids, ...	—	–	0	5	2	7	7	247
26.	,, ,, with purulent discharge from the nose, no enlarged tonsils nor adenoids,	—	—	0	—	1	1	1	
27.	,, ,, no enlarged tonsils nor adenoids, ...	15	14	29	28	11	39	68	
28.	Internal ear deafness, ...	—	—	0	1	—	1	1	
		159	149	308	387	305	692	1000	

It has to be added that the children here examined correspond to the poorest classes of children in Scottish cities.

Dr. Cheatle adds:—" It will be seen that—

The ears were normal in - - -	432
The external ear was affected in - -	49
The middle ear was affected in - -	518
The internal ear was affected in - -	1
	1000"

The foreign bodies found in the ear included a piece of wooden match, a pea (4 cases), a piece of folded paper (3 cases), a piece of cotton wool (6 cases), a small splinter of wood, a blue bead (2 cases), a piece of dried grass.

(*d*) *From Dr. Kerr's Report.*

In his Report for the year ended 25th March, 1903, Dr. Kerr, medical officer of London School Board, says:—

"Another important avenue of knowledge is through the hearing. This sense presents great difficulties in school measurement. The time and trouble required prevent a general examination such as is applicable in the case of vision.

"We have not made any measurements in London, but from analogy it is probable that deafness alone interferes to a very considerable extent with the educational progress of at least 5 per cent. and, to some extent, with at least 10 per cent. more.

"Apart from actual deafness of permanent nature there are catarrhal conditions in younger children frequently present with debilitated conditions and want of exercise, want of development of respiratory capacity and retarded school progress. The adenoid hypertrophy associated with open mouth and frequently excessive nasal discharge has mental accompaniments of bad memory and incapability of maintaining the attention. In these cases, where the child also snores at night, operative means are necessary. Unfortunately, too often, even on medical advice, parents believe that the children will grow out of it, but they are liable in the meantime to suffer sadly in educational efficiency and instability of character and to have liability to permanent deafness or greatly increased mortality from zymotic diseases.

"About 1 per cent. of the children, roughly estimated, present discharging ears. The utmost efforts of the teachers should be directed to getting such home treatment or operation that the discharge is stopped. Neglected discharging ears quite commonly lead to fatal results before school days are past."

CHAPTER XV.

Examination of the Eyes and Vision.

1. *What the Teacher should observe.*

The teacher should habitually scan his class to discover eye troubles. Once he grasps their importance, he will at a glance pick out those affected. He should mark for examination the following varieties of children:—

(*a*) All those with "sore eyes"—the name commonly given to chronically or acutely inflamed eyelids;

(*b*) All those with styes;

(*c*) All those whose eyes are congested and "red" where they should be blue-milk-white;

(*d*) All those that squint either constantly or occasionally;

(*e*) All those that hold their reading books nearer to the face than one foot;

(*f*) All those that put their books at arm's length in order to read;

(*g*) All those that cannot read blackboard writing freely from their seats;

(*h*) All those that "peer" like a cat in the sun, or shut their eyelids to a chink;

(*i*) All those that have a drawn, anxious look when reading from map, or blackboard, or wall-card;

(*j*) All those that slope the head to read;

(*k*) All those that complain of headaches, or show very small pupils at the end of the day;

(*l*) All backward children showing one or more of those symptoms;

(*m*) All those that fear the light.

The reasons for this rough first inspection will appear

among the details following. The grosser eye-diseases are easily suspected. But in children, the capacity to accommodate the long-sighted eye to vision of near objects is very great, and frequently cannot be detected by any reading test. But every teacher can recognise "blear-eye," squint, hairless eyelids, &c. These have all very direct bearings on the primary functions of the eye, and may be an index of more serious conditions.

2. *General Considerations.*

The eye is in every respect the leading sense. Its importance in the acquisition of knowledge can scarcely be over-rated. It has nervous connections with all the chief regions of the brain. It is a channel for sensations of movement and sensations of colour. Its delicacy of discrimination is immeasurably fine. On it depends, in a more intimate way than on any other sense, success in the struggle for life. Accordingly, on general grounds, it is of the first importance to ensure that the eye shall be maintained in the condition of greatest efficiency, that it shall not suffer from over-stress at any period of life, that it shall be carefully watched in its growth at the critical ages, that it shall be kept free from disease and safeguarded from every risk that might produce injury or defect. How far educated and uneducated alike are from this ideal, the ghastly records of the institutions for the blind and the less ghastly, but not less important, records of every ophthalmic surgeon and optician are enough to show. It is still the case that children suffering from refraction defects of endless variety are permitted to engage in reading, writing, figuring, and all the delicate vision-work of the school. Persons enlightened enough on matters of general knowledge frequently are so ignorant of the structure and functions of the eye as to feel insulted when an observer suggests the advisability of spectacles after a certain age. In the general business of life, however, defects are readily enough discovered; they are rapidly found to disqualify for various occupations; they become an occasion for the application of artificial selection.

In school it is different. Some authorities have maintained that of children's eyes probably not more than 10 to 12 per cent. are normal (or emmetropic). In many of those affected, the deviation from the normal is so slight that clear vision is possible without artificial aid. In the majority, however, the deviation is so great that normal vision without artificial correction is impossible. In some of these children, the condition is fully developed before school-life begins. In others, inherited pre-dispositions to certain forms of short-sightedness are elicited and aggravated by the conditions of work at school. This fact is of fundamental importance. It impels the school oculist to a careful estimate of the circumstances that originate or aggravate defects of vision and to institute such habitual precautions as will reduce their occurrence to a minimum. In every school a certain percentage of children suffer from defective vision; a certain percentage continue to work without corrective eye-glasses, and thus a certain number of children are not only handicapped in the struggle to keep the educational pace with children of normal vision, but, in many instances, suffer from the nervous results of defective vision—headaches, irritability, exhaustion, loss of interest, feebleness of will.

In the sequel, it will be shown that these generalities have abundant foundation in fact. The records of the ten schools examined in Edinburgh and Aberdeen would alone be enough for our purpose; but they can be supplemented by hundreds of examinations conducted by skilled oculists in Britain, Europe, America, and elsewhere. Among the known facts of medicine, there is nothing better established than the prevalence of eye-defects. The importance of their correction is equal to the importance of the eye itself. For these reasons, we enter into considerable detail regarding the diseases of the eye and the leading defects of refraction.

To the description of the diseases some indications of treatment are appended. Needless to say, these indications are very incomplete. They are intended to emphasise the importance of each disease. This must be the justifi-

cation for including even a hint of treatment in a purely inspectorial examination. An additional justification is that the eye is, in every relation, so important that, in season and out of season, the care of it should be impressed on teacher, examiner, and child equally.

3. *Diseases of the Eyelids.*

(*a*) *Stye or Hordeolum.*—A stye occurs in children either as the result of some general condition—anæmia, indigestion, general mal-nutrition, or as the result of some uncorrected error of refraction. Whenever a stye or persistent irritation of the lids continues to appear, defects of refraction should always be suspected.

Appearances.—When fully developed, a stye appears as a round, reddened swelling on the margin of the eyelid. Often it occurs at the root of a hair. It is due to suppuration in the connective tissue of the eyelid. Like all inflammations, it causes considerable pain and throbbing in the early stages. In a day or two, a yellow head appears and the small abscess bursts externally. Styes show a remarkable tendency to appear in crops. In these cases, any error of refraction should be at once looked for and corrected.

Treatment.—In its early stages, the style is best treated by compresses of boracic or lead lotion. Only when it is about to burst is an incision advisable. Poultices should not be applied.

(*b*) *Blepharitis.*—Blepharitis, which is another name for "red eyes" so common in children, is an inflammation of the margin of the eyelids. It is seen most commonly in dirty and unkempt boys and girls and in those of tubercular tendency. It may follow measles. It is frequently an indication of uncorrected long-sightedness or hypermetropia.

Appearances.—The eyelids become red and inflamed. There ensues profuse secretion, which becomes glutinous and glues the eyelashes together in small groups. Along the margin of the eyelids are formed scabs, under which

ulceration proceeds. All degrees from superficial scabbing to severe ulceration of the lid may be present. In the more severe cases, the hair follicles may be destroyed and the lid consequently shorn of eyelashes.

Treatment.—The crusts should be moistened with warm boracic lotion. The scabs should then be picked off with some blunt instrument. The ulcerated surface thus revealed should be smeared twice a day with Pagenstecher's ointment.

In addition, strumous and ill-nourished children should have tonic treatment—cod liver oil, hypophosphites, syrup of iodide of iron. Any error in refraction should, of course, be corrected.

(*c*) *Blepharospasm.*—By blepharospasm is meant an involuntary twitching of the eyelids. This is due to a clonic (rapidly intermitted) or tonic (prolonged) contraction of the muscle surrounding the eyelids—the orbicularis palpebarum. The contractions are usually due to some local condition of the lids, or conjunctiva, or some error of refraction. When these conditions are relieved the twitching usually disappears.

(*d*) *Trichiasis, Distichiasis.*—These conditions usually follow in all cases of blepharitis. As a result of the healing process, the eyelashes become misdirected. They rub against the conjunctiva, causing a great deal of irritation and sometimes ulceration of the cornea. In distichiasis (which is congenital) there is a double row of lashes—the inner directed inwards and rubbing against the cornea.

Treatment.—This consists in plucking out the misdirected hairs. If, however, the condition persists, further operative procedure is indicated.

(*e*) *Tarsal Cyst or Chalazion.*—A tarsal cyst is a tumour of the tarsus, which is the cartilage that lies immediately beneath the conjunctival lining of the eyelid. The secretion of the tarsal gland (Meibomian glands) fails to find exit and becomes encysted. As a result, there is

chronic inflammatory thickening around the gland. A single cyst may occur, but groups of cysts are common. They are probably more common in the lower lid than in the upper. From the skin surface of the eyelid, the cyst gives the impression of a small pea buried in the substance of the lid. The skin is quite moveable over it; but the conjunctiva is usually somewhat swollen and granular. When the cyst suppurates, it always "points" on the conjunctival surface—thus differing from a stye, which points externally.

Treatment.—An incision at right angles to the lid is made over the cyst on its conjunctival surface. The contents are then shelled out with a small scoop, which tears up the capsule and thus helps to prevent recurrence.

4. *Diseases of the Conjunctiva.*

(*a*) *Simple or Catarrhal Conjunctivitis.*—A simple or catarrhal inflammation of the conjunctiva is the condition most likely to be met with in children. It may assume an acute or a chronic form. The acute form is contagious and, once introduced, may spread through a school with great rapidity. It is common among children of the labouring classes. One form of it occurs more frequently at certain seasons of the year—chiefly in the spring and autumn. It usually begins in one eye and soon spreads by infection to the other. It may result from the presence of foreign bodies in the eye; it may be a sequel to measles; or it may arise from some condition of the nose and pharynx.

Symptoms.—The affected eye begins to feel heavy and gritty, as if some foreign body were present. There is constant blinking. Light dazzles the eye. The conjunctival lining of the lids is red and swollen with free secretion of mucus, which soon becomes muco-purulent. In the mornings, when the child awakes, the lids are found stuck together by the secretion. The cornea is not usually involved in the inflammatory process.

Treatment.—As the condition is contagious, precautions must be taken to prevent its spread from one child to

another. The child affected should be removed from school, and, if possible, isolated. Handkerchiefs, towels, basins, or other articles used by him should not be used by other children either in the school or in the home. The common home treatment for the condition is poulticing with bread or potato poultices, or bathing of the eye with milk or tea. This treatment should never be encouraged. The eye should be protected from strong light, but it should not be covered up, as it so often is, by a handkerchief or bandage tied round the head.

The affected eye should be bathed very frequently, once every three or four hours, with weak warm boracic lotion, or corrosive sublimate lotion (one in five thousand). Simple vaseline should be rubbed along the edges of the lids at bedtime; this prevents the retaining of the secretion and the glueing together of the eyelids.

The chronic form of conjunctivitis usually follows an acute attack. The margins of the lids are frequently involved, and thus chronic conjunctivitis and blepharitis are associated.

In the treatment of the chronic condition, stronger measures are required. Astringent lotions, for example, alum lotion, must be used. The lids may need to be touched with nitrate of silver. The child's general health must also be attended to.

(*b*) *Phlyctenular Conjunctivitis.*—This condition occurs most commonly in ill-nourished children, especially among those living in bad hygienic and crowded surroundings. It is particularly liable to affect the tubercular child. It frequently follows scarlet fever and measles. Among children with errors of refraction, it occurs most commonly in association with astigmatism.

Symptoms.—Phlyctenular conjunctivitis tends to recur year after year. It appears in the form of small, greyish-white elevations at the margin of the cornea. Only one may be present, or there may be a number running round the corneal margin. Passing out from the phlyctenules is seen a small leash of blood-vessels. The phlyctenules

frequently appear also on the surface of the cornea. Here they may become yellow, break down, and give rise to superficial ulcers. These, unless properly treated, may give rise to roughening and consequent dimness of the cornea. Usually a permanent symptom is great fear of the light (photophobia). The child keeps its eyes tightly closed; it sturdily refuses to open them when requested, and delights to remain in dark corners. These conditions readily attract the attention of parents or teachers.

Treatment.—The child should have general tonic treatment—good food, iron and cod liver oil, exercise in the open air. The photophobia may be so severe as to require special treatment. He should be encouraged to open his eyes. Atropine (four grains to the ounce of water) may be dropped in three times a day. If there is discharge, frequent bathing with boracic lotion is indicated. When the irritation has subsided, Pagenstecher's ointment should be used—a piece the size of a small pea to be placed in the eye twice a day, and the lids rubbed over it. If astigmatism be present, the correcting eye-glasses should be used constantly.

(*c*) *Granular Conjunctivitis* (*Trachoma*).—This condition, though not very common among school children, is nevertheless met with. It is infectious. It is seen chiefly among the poorer classes, being a result of bad ventilation, insufficient nutrition, and insanitary environment.

Symptoms and Appearances.—Granular conjunctivitis appears in the form of small, round granulations on the conjunctiva of the lids. These granulations (trachoma bodies) resemble small papillæ. They are greyish-white in colour. They often run in rows. Usually there is present at the same time a catarrhal conjunctivitis with a profuse purulent discharge. The papillæ after a time soften, burst, and discharge a contagious secretion. When the cicatrisation takes place there is a loss of substance of the conjunctiva. As a result, there appear white threads running parallel to the lid margin. An acute attack lasts usually for about a month, but in many cases the condition

becomes chronic and may continue for months or years. In the more chronic cases, the cornea becomes involved.

Treatment.—Children with trachoma must be removed from school; they must be kept separate from other children at home; they must have towels, handkerchiefs, sponges, &c., for their own use. Their general health should be attended to; they should have good food and abundance of fresh air. To restrain the catarrhal inflammation, eye-washes of boracic lotion are useful. Weak astringent lotions are also of value. For the chronic cases, the best local application is blue-stone, which should be applied twice or three times a week.

5. *Diseases of the Cornea.*

(*a*) *Interstitial Keratitis.*—In this condition the whole cornea becomes infiltrated and opaque; there is no loss of substance. The condition may appear any time between the ages of seven and twenty-one; it is probably commonest about the age of puberty, and when found in schools it is likely to occur among the higher classes. It is a self-terminating disease. It may last a long time, from six to ten months, but ultimately the opacity clears away entirely.

Symptoms and Appearances.—Both eyes are usually affected, but one before the other. The disease begins at the margin of the cornea; it gradually spreads over it until the whole is involved by a diffuse, greyish opacity, the appearance differing slightly according to the degree of infiltration. Ulceration is never present. The disease clears up in the same order as it begins—margin first, centre of cornea last. The iris may or may not be involved. The prognosis is most favourable when the iris is not involved. The condition is commonest in children suffering from congenital syphilis.

Treatment.—Along with the anti-specific remedies, iodide of potash and mercury, tonics for general health should be prescribed. The tendency to iritis may be obviated by the use of atropine (four grains to the ounce). The eyes should be protected from strong light by a shade.

(*b*) *Conical Cornea.*—In conical cornea, the central portion of the cornea is thinned. As a result, the curvature of the central area of the cornea becomes too great; the curvature of the peripheral area becomes correspondingly less. The cornea becomes more conical. As the cornea is one of the chief refracting media of the eye, this alteration in shape gives rise to myopia (short-sight) and irregular astigmatism. A conical cornea usually affects both eyes, but unequally. The condition is easily diagnosed; it alters the expression considerably; the conical shape may be seen when the cornea is looked at from the side.

Treatment.—In most cases it is possible, by the use of negative, spherical, and cylindrical lenses, to secure some degree of optical correction. The improvement is always very slight. Various surgical operations have been tried for improving the vision, but the results are doubtful.

(*c*) *Corneal Ulcers, Corneal Nebulæ.*—Corneal ulcers are due to suppurative inflammation of the cornea. When they heal, they leave white specks on the clear cornea. These specks vary in opacity. They may be almost transparent and visible only with special light, and are then named *corneal nebulæ.* They may be more dense, and are then named *maculæ,* or they may be distinctly opaque and white, and are then named *leucomata* (leukos, white). As a rule, the presence of corneal ulcers is indicated by symptoms that attract the observer. The corneal *nebulæ,* &c., are very frequently so marked as to cause disfigurement. The medical inspector should always examine carefully for nebulæ. They are an important index of constitutional history and conditions.

6. *Diseases of the Iris.*

(*a*) *Iritis.*—Iritis, or inflammation of the iris, is met with in children about the age of puberty. It is not common in young school children. It occurs in children of gouty parents; in young girls, as one among the disturbances attending the onset of the menstrual functions;

it may accompany interstitial keratitis; it occurs also in rheumatic or syphilitic children. It may also result from injury.

Symptoms.—The condition is usually serious. The blood-vessels round the cornea are injected. The iris is muddy in appearance. It is sluggish in movement on exposure to light. As a result of the inflammation, it tends to become attached to the anterior surface of the lens. Consequently, it tends to dilate irregularly.

Treatment.—To keep the pupil dilated and so prevent attachments to the lens, atropine is necessary. Equally important is the general treatment of the condition that gives rise to the iritis—gout, rheumatism, &c.

7. *The Eye as a Refracting System or Camera.*

(*a*) *Normal or Emmetropic Eye.*—In the normal eye, rays of light pass consecutively through the anterior clear surface of the eye (cornea), through the liquid in the space immediately behind it (the aqueous humour), through the lens, through the mass of jelly (the vitreous humour) behind the lens, and at last they strike the back of the eye, which is lined with the retina. In passing through the structures enumerated, the rays are refracted as in passing through an ordinary magnifying glass (a convex lens). They are brought to a focus on the retina. The rays thus focussed form on the retina an inverted image of the object. So far, the eye acts precisely as a photographic camera—the retina is the ground-glass plate; the cornea, aqueous, lens, and vitreous together, are equivalent to the photographic lens.

(Emmetropic: Greek—en, within; metron, measure; ops, eye.)

The retina of the normal eye is precisely placed at the principal focus of the refracting system. For distinct vision, it is essential that the image shall be formed precisely on the retina.

In this description, we have assumed that the eye is at rest and that the rays of light come from a distant

object. When the object is distant, the rays from it, by the time they fall on the eye, will be practically parallel to each other, and if the object is infinitely distant, the rays will be perfectly parallel. In the normal eye when at rest, parallel rays are focussed on the retina.

(*b*) *Accommodation.*—If, however, the rays come from a near object, they are not parallel on entering the eye, but divergent. Consequently, in order that they shall be focussed on the retina, one of two things must occur—either the retina must be drawn backwards, like the plate in a camera, or the refracting power of the eye must be increased, as if a thicker lens were substituted for a thinner. In the eye, the retina cannot be drawn backwards. Accordingly, the refracting power is increased. This is done by the thickening of the "lens," which, in the eye, is capable of slight alteration in shape. The other refracting media (cornea, aqueous, vitreous) remain the same. This capacity of the eye to increase or diminish its refracting power by thickening or thinning its lens as required is called ACCOMMODATION.

(*c*) *Range of Accommodation—Near and Far Points.*—The Range of Accommodation varies considerably in different individuals. For the normal eye, the far point is infinity. For practical purposes, this means any distance beyond twenty feet; because rays coming from an object more than twenty feet away enter the cornea parallel, and the refracting power of the eye at rest is sufficient to bring them to a focus on the retina. The near point is, for practical purposes, the nearest point at which No. 1 of Snellen's test types (see below) can be read distinctly. It varies with age; it normally recedes as life advances, and a person of age forty-five or upwards must hold the types farther from the eye in order to see them distinctly.

The distance between the near point and the far point is known as the "range of accommodation."

(*d*) *Long-Sighted or Hypermetropic Eye.*—If the eye, from front to back along the axis of vision, is so SHORT

that parallel rays—that is rays from a distant object—do not meet precisely on the retina, but would meet only if prolonged behind it, the result is a blurred image. The eye is then called hypermetropic. The individual suffers from HYPERMETROPIA.

(Greek—Hyper, over; metron, measure; ops, eye.)

(*e*) *Short-Sighted or Myopic Eye.*—If the eye from front to back along the axis of vision, is SO LONG that parallel rays—that is rays from a distant object—meet in a focus before they reach the retina, the result is again a blurred image. Such an eye is called myopic. The individual suffers from MYOPIA.

(Greek—Muō, I close; ops, eye.)

Briefly, the long-sighted eye is axially too short; the short-sighted eye is axially too long.

(*f*) *Astigmatism*—(a, not; stigma, point or spot).—When looking at a clock-face, a person may notice that the figures XII. and VI.—vertical meridan—are clear and black, while IX. and III.—horizontal meridian—are dim and more or less grey. If this occurs, the eye is astigmatic. A black line seen vertically is darker than the same line seen horizontally. This is due to the fact that rays passing through the cornea in the vertical plane do not come to a focus at precisely the same point as rays passing through it in the horizontal plane. Thus the rays in the vertical plane may be focussed on the retina (normal); the rays in the horizontal plane may be focussed in front of the retina (myopic), or behind the retina (hypermetropic).

When astigmatism is present, the ray-planes are usually at right angles to each other. Hence a line joining XII. and VI. is dark; a line joining IX. and III. is dim. Or the vertical line may be dim and the horizontal line dark.

The defect is due to an abnormal shape of the cornea, not to the axial length of the eyeball (as in hypermetropia or myopia). The vertical curvature of the cornea may be

greater or less than the horizontal. This gives rise to the difference of focussing already mentioned.

Astigmatism is extremely common in small degrees. It is a very common accompaniment of hypermetropia. The minor degrees are of little consequence and may need no correction. The greater degrees may lead to severe eye-strain and headaches.

(*g*) *Convergence, Binocular Vision.*—When both eyes are looking at a distant object and are at rest, their axes are parallel. When they look at a near object, their axes must converge until they meet at the object. In binocular vision, this convergence is perpetually happening. It is brought about by the internal recti muscles, which by contracting simultaneously roll the eye-balls inwards. The object of convergence is to bring the Yellow Spot of each eye to bear on the same point. The Yellow Spot is the part of the retina where vision is most distinct.

(*h*) *Squint* (*Strabismus*).—It is important to record all cases of squint or strabismus. Dr. George Mackay gives the following definition:—" Strabismus (squinting) is the term applied when the visual axes do not cross, or do not appear to cross, upon the point of fixation." Each eye has its own line of vision or visual axis. When both eyes are looking at an infinite distance their axes are practically parallel. When the eyes converge, the axes meet at an angle. In binocular vision, the eyes as a rule so converge that the axes cross each other at the object. Where this crossing at the object (or point of fixation) does not occur, squinting results. One eye may turn inwards more than the other; the squint is then convergent. One eye may turn outwards; the squint is then divergent. One eye may squint at one time, the other at another; the squint is then alternating. There are other varieties, which depend on the upward and downward movement of the eye.

Test of Squinting.—In the well-marked cases there is no difficulty in diagnosing squint. In the alternating

cases there is, as a rule, greater difficulty. In the examination of children at school, alternating cases may escape notice. They will, however, probably be reported by the teacher.

Dr. George Mackay describes the alternating exposure test as follows:—"The simplest means which can be employed without any apparatus is to direct attention to some small, remote, but well-defined object, preferably on a level with the eyes (or with the head thrown back it may be at a higher level, *e.g.*, a chimney top). The observer should place himself before the patient in such a position that he can easily watch the eyes without interfering with their lines of vision to the object selected, and then rapidly slip the back of his hand or an opaque card in front of one eye of the patient. If the remaining exposed eye possesses sufficient vision to see the object, and has been exercising correct power of fixation, it will remain unmoved; but if it instinctively turns towards the object of regard, it reveals at once the faultiness of its previous position. Let the cover next be quickly transferred from the first to the second eye, and note whether the former remains with fixed gaze on exposure or alters its position. If the muscular equilibrium of the eyes is perfect (orthophoria), no movement will be detected. If any movement of adjustment occurs, strabismus is at once revealed."—("Encyclopædia Medica," art. *Strabismus.*)

Importance of Examining Squints.—Where, from any cause, muscular or nervous, an eye habitually squints, it tends to become functionally useless and may ultimately become blind. It is, therefore, of primary importance to detect squints early and to subject the child to suitable treatment or eye exercises.

8. *Methods of Determining the Refraction of the Eye.*

(*A*) *Subjective Method.*

(*a*) *Acuteness-of-Vision Test.*—When a child's eyes are being examined, it is always advisable to make a pre-

liminary inspection of certain features. For instance, a large eye with dilated pupil suggests myopia or short-sight. A small eye with contracted pupil suggests hypermetropia. The child himself may be old enough to give some information. He may see distant objects distinctly; but he cannot read or see near objects, especially in dim light, without discomfort. In this case, he is probably hypermetropic. On the other hand, he may readily undertake reading or near work, but he cannot see distant objects. In this case, he is probably myopic. Except in very small degress of myopia or hypermetropia, there is usually some peculiarity of look or habit to suggest or indicate the defect.

The acuteness of vision may be tested by Snellen's types. A sheet of these is inserted at the end of the book.

To use the types proceed as follows:—

(1) Hang the sheet in a good light.

(2) Place the child at a distance of 6 metres (about 20 feet) from the sheet. The light should fall on the card from behind the child.

(3) Test each eye separately.

(4) First, hold a piece of cardboard or some opaque object in front of the left eye, leaving the right free. If the child can read all the letters of the line D = 6, then the acuteness of vision for the right eye is normal.

(5) Second, cover the right eye and proceed to test the left. If he can read D = 6, then the acuteness of vision for the left eye is normal.

(6) If the child is able to read the D = 6 line with both eyes, his acuteness of vision is normal. This is recorded as $V. = \frac{6}{6}$. The meaning of this fraction is that the line marked D = 6 can be read by a normal eye at a distance of 6 metres. The numerator of the fraction expresses in metres the greatest distance at which the line is actually read—that is, 6 metres. The denominator of the fraction expresses in metres the greatest distance at which the line ought to be read.

The other lines are similarly numbered. Thus the line D=9 could be read by a normal eye at 9 metres' distance. But if a child can read it only at 6 metres' distance, there is some defect in the acuteness of vision. This would be expressed in the form $V=\frac{6}{9}$. This means that the child at 6 metres' distance can read only the line that a normal eye could read at 9 metres' distance. Similarly, with the other fractions, $\frac{6}{12}$, $\frac{6}{18}$, $\frac{6}{24}$, $\frac{6}{36}$, $\frac{6}{60}$.

In classifying defects in the acuteness of vision, Good would mean $\frac{6}{6}$; Fair, $\frac{6}{9}$ to $\frac{6}{18}$; Bad, $\frac{6}{11}$ to $\frac{6}{60}$ and upwards. It is, however, essential to give the precise quantities. Observations classified as good, fair, or bad, but unaccompanied by the precise Snellen's figures, or figures constructed on similar principles, are valueless. So-called "rough-testing" of the eye, unless it is done in terms of a scientifically-thought-out system, is best left undone. Of all organs, the eye least deserves to be trifled with.

Up to this point, any person capable of understanding what we have written can test the acuteness of vision—not "roughly," but—scientifically. There is no good reason why a teacher trained in this work should not make a first inspection of every child admitted. This would enormously economise the work of the medical inspector, who should then be able to deal with the worst cases first.

This is borne out by the experience of Dr. Kerr, medical officer to the London School Board. In his first annual report (for the year ended 25th March, 1903) he writes:—

"The returns from the oculists can be compared with the vision testing done by the teachers in 1900:—

PERCENTAGE WITH NORMAL VISION.

Standards	I.	II.	III.	IV.	V.	VI.	VII. &c.
Examination by Teachers, 1900,	32	40	45	50	53	56	61
Examination by Oculists, 1902,	54	61	70	73	75	78	80

"The slighter grades of defect are very liable to error in testing by letters, the child's personal equation and inability to make the mental effort of perceiving, coming in.

"The results of the oculists' examinations in 1902 and of the teachers' in 1900 are, in respect to bad vision, almost identical:—

Bad Vision ($V = \frac{6}{18}$ or worse).

Standards	I.	II.	III.	IV.	V.	VI.	VII. &c.
Teachers, 1900, -	9·9	9·4	9·3	8·7	8·4	8·7	8·4
Oculists, 1902, -	11·6	11·5	9·6	9·2	8·9	8·5	8·8

Here it is appropriate to quote some further striking figures from Dr. Kerr's report:—

"*Defective Vision and School Progress.*—There is an association between defective visual acuity and retarded position in school. If the children be divided into two groups of precocious children (younger than the average in their standard) and retarded children (older than the average age for their standard), then, although when considering the whole of the children the younger ones have most defective vision, yet in this grouping the older "retarded" group present more defective vision than the younger "precocious" group.

Percentages with Defective Vision.

	Age last Birthday,	8	9	10	11	12
14,079 Boys	Precocious (8196),	29·8	25·5	19·9	20·5	18·7
	Retarded (5883),	47·2	40·0	29·3	27·5	29·6
13,978 Girls	Precocious (8090),	33·2	27·5	26·9	25·1	24·2
	Retarded (5888),	57·1	47·0	40·5	35·9	32·4

"Probably this means not only that defective vision retards progress in school, but also that the mentally backward children do not respond to the visual tests so well. This last idea is borne out by the fact that the oculists' more experienced testing found less slight defect (fair vision), by about 25 per cent. at each age of all examined, than the teachers'; and in testing very young children, the greater the time and trouble taken the less the proportion of defects found."—(*Ibid.*, p. 16.)

These numbers and percentages will form a permanent standard of reference. It is important to note the very clear correlation between the stage of educational progress and the degree of eye-defect.

(*b*) *Acuteness of Vision in Hypermetropia.*—When the

eye is slightly hypermetropic, the child at 6 metres may, by using its accommodation, still be able to read line D = 6. To test whether hypermetropia is really present, place a convex lens (number ·25, or ·50, or ·70, or 1, &c.) in front of the eye. If the child can still read the bottom line when, say, looking through a No. 1 convex lens, it means that he has been using his accommodation, and he is hypermetropic at least to the extent of a No. 1 lens. With higher degrees of hypermetropia, the child at 6 metres' distance may be able to read only D=9, or D=18, or even D=60. He may not be able to see the largest letter until it is placed much farther away.

(*c*) *Acuteness of Vision in Myopia, and Astigmatism.*—If the child cannot read D = 6, but is able to read the line next above it, D = 9, and if a convex lens does not improve his vision, then he is probably myopic, or astigmatic.

Place a *concave* lens in front of the eye. If he can now read line D = 6, his defect is myopia. If he cannot yet read line D = 6, his defect is probably astigmatism. But this is more easily discovered by the method of retinoscopy.

(*d*) *Testing for Near Vision.*—To test near vision proceed as follows:—

(1) Ask the child to read the paragraphs of Test Types for Near Vision.
(2) Note the number of the paragraph.
(3) Note the greatest distance at which the paragraph is actually read.
(4) If the type marked "1 m.," that is, type read by a normal eye at 1 metre distance, cannot be read at a greater distance than 25 cm.—a fourth of the normal distance—then the child has 4 degrees of myopia.

So with the other paragraphs.

(*B*) *Objective Methods.*

There are three objective methods—the indirect

TEST TYPES FOR NEAR VISION.

D = 0,5 m.

As to my boat, it was a very good one, and that he saw, and told me he would buy it of me for the ship's use, and asked me what I would have for it.

D = 0,6 m.

In this distress the mate of our vessel lays hold of the boat, and with the help of the rest of the men, they got her slung over the ship's side.

D = 0,8 m.

A little after noon I found the sea very calm, and the tide ebbed so far out, that I could come within a quarter of a mile of the ship.

D = 1 m.

In search of a place proper for this, I found a little plain on the side of a rising hill, whose front towards this little plain was steep as a house side.

D = 1,25 m.

Then I took the pieces of cable which I had cut in the ship, and laid them in rows one upon another, within the circle between these two rows of stakes.

D = 1,5 m.

When I had done this, I began to work my way into the rock, and bringing all the earth and stones, that I dug down, out through my tent.

D = 2,25 m.

For in this way you may always damp our ardour.

D = 3 m.

I saw no one there.

D = 4 m.

For the ensuing

Note.—Specially-designed Test Sheets or Books for Near Vision may be obtained from the Opticians. The types given above are intended only to illustrate the method.

The model was provided by Messrs. CURRY & PAXTON, London.

method, the direct method, retinoscopy. All three are important, but for the purposes of school inspection retinoscopy alone is sufficient. It is the best method with children. It reveals the defects without the necessity of questioning.

To perform *Retinoscopy* proceed as follows:—

(1) Darken the room.

(2) Place an ophthalmic lamp or gas-jet in a position immediately above the head or at one side. The light must be so shaded as to leave the face in shadow.

(3) Sit facing the child at a distance of about 1 metre or $1\frac{1}{2}$ metres (3 ft. 3 in. to 5 ft.).

(4) Take a retinoscopy mirror (which has a focal length of 25 cm.). Hold it so that the light from the lamp is reflected into the eye. Look through the central opening. You will see a red reflection, which occupies the area of the pupil. Instead of being black, the pupil is red.

(5) Rotate the mirror very slightly and slowly from right to left and left to right. At each movement a shadow is seen to encroach on the margin of the red area.

(6) Fix attention on this shadow.

(7) If, when you rotate the mirror to the left, the shadow also moves to the left, then the eye is *myopic*. The shadow moves *with* the mirror. So on rotating the mirror to the right, the shadow moves to the right.

(8) If, when you rotate the mirror to the left, the shadow moves to the right, then the eye is hypermetropic, or emmetropic. A low degree of myopia will give the same result, if the examiner is sitting nearer to the child than the child's "far point." But, as a rule, when the shadow moves "against" the mirror, the eye is either hypermetropic or emmetropic.

(9) Note also the degree of distinctness of the shadow and the speed of its movements.

X

(10) If the hypermetropia, or myopia, is slight in amount, the shadow comes on quickly, is very distinct, moves quickly and further across the illuminated area. If the hypermetropia or myopia be high, the shadow is fainter and moves more slowly across the area.

(11) To correct the error present, lenses are successively placed in front of the eye and the shadow tested until it is found to move in the direction opposite to its original movement. The first lens that gives such a reversal of the shadow is the correction necessary. With the further details of correction, the medical inspector need not concern himself.

(12) *Summary.*—If the shadow move *against* the mirror, hypermetropia or a low degree of myopia is present. If + ·5 D cause a reversal of the shadow, the defect is a low degree of myopia. If + 1 D cause a reversal, the eye is normal. If more than + 1 D is necessary to cause a reversal, the defect is hypermetropia.

Note.—For these testings it is necessary to have a retinoscopy mirror (*i.e.*, a mirror with focal length of 25 cm.) and a graduated series of lenses.

9. *Hypermetropia—Causation and Symptoms.*

(*a*) *Causation.*—Hypermetropia is the most common refractive defect in the eye. It is probably always congenital. It is really the result of an imperfectly developed or a deformed eye-ball.

(*b*) *Symptoms.*—The hypermetropic child must, for near vision, exercise his accommodation. He thus puts a strain on the eye. But in continuing his gaze at the near object, for example, his reading book, he cannot maintain his accommodation constantly at the same tension. Consequently, his eyes feel tired. There may be eye-ache and head-ache. There may also be squinting. Where the refractive error of one eye is greater than that of the other, there is certain to be squinting. The eyes

are usually red from congestion. The lids are often inflamed.

In the hypermetropic child, the eyes are usually small; the anterior chamber is shallow; the pupil is narrow.

Even when hypermetropia has been corrected by appropriate glasses, the child should be inspected from time to time during its school course. The hypermetropia may, in some cases, alter, and this alteration may be such as to demand further correction.

10. *Myopia—Causation and Symptoms.*

(*a*) *Causation.*—Unlike hypermetropia, which appears before school-age, myopia manifests itself most markedly when the school-age begins. The causation of myopia is still a matter of dispute, but masses of statistical material tend to confirm the theory that myopia is at least developed or aggravated by the necessary adaptation of the eyes for near work when children go to school. Professor Königshöfer, of Stuttgart, writes—"We should always bear in mind that a hypermetropic and an astigmatic eye are merely abnormal eyes, but that a myopic eye is a diseased eye. Myopia, however, is generally only recognised when it is too late; and in a large majority of cases myopia is an acquired disease. Although a few ophthalmic surgeons have recently expressed a contrary opinion, yet they cannot get rid of the fact established by an examination of hundreds of thousands of school children, that the cause of myopia is near work and that schools make children myopic. Facts such as those, for example, given in Seggel's statistics cannot be got rid of by theoretical views. Seggel examined 1600 soldiers in the Munich garrison and found—

"(1) That among the peasants 2 per cent. were short-sighted;

"(2) That among day-labourers and town dwellers, 4 per cent.;

"(3) Among artizans and those engaged in trades, 9 per cent.;

"(4) Among merchants, writers, and compositors, 44 per cent.;

"(5) Among those who had completed their studies at public schools, 65 per cent. had myopia." *

Briefly, the straining to accommodate for near work induces a lengthening of the eye-ball, and the result is myopia. Now, the work of the school-child necessarily involves near vision for some hours of each day. It must, then, be said that school-work produces or increases myopia.

From this cardinal proposition, two things are obvious —first, that myopia is among the most important of a school-child's defects; second, that with due care, it is largely preventable, at least in degree.

The school inspector will, therefore, make a minute inspection of it. He will record, too, the conditions that, in each school, tend to induce myopia—the placing of the windows, the glittering surfaces of blackboards and any similar circumstance that might induce eye-strain. He will watch the classes at work to ascertain the varieties of near work. He will take account of the child's general health. He will advise the reduction of near work for those affected.

11. *Diagnosis of Astigmatism by Retinoscopy.*

The medical inspector's problem is to ascertain the presence or absence of astigmatism. He is not concerned with the variety of it or the degrees of it. He will find, however, that it is an advantage to classify the varieties of it. This he can readily do by retinoscopy and appropriate lenses.

(1) If, on examination with the retinoscopy mirror, we find that the shadows are oblique, not vertical or horizontal, we know at once that astigmatism is present.

(2) If, however, the shadows are horizontal and vertical, we notice that the shadows are clear, more distinct, and move more quickly in one meridian than in another.

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* "The Prevention of Disease," p. 734. Translated from the German by Wilmott Evans. Constable & Co.

(3) We test each meridian separately. This is done, not by the ordinary spherical lenses (convex or concave), but by cylindrical lenses (convex or concave).

(4) Correct, say, the vertical meridian by finding the cylindrical lens that gives a reversal of the shadow. Then correct the horizontal.

(5) As astigmatism is almost always associated with either hypermetropia or myopia, spherical lenses must also be used to correct these.

(6) Astigmatism may be of the following varieties:—

(*a*) *Simple hypermetropic astigmatism,* where the rays in one plane are focussed on the retina (normal), and rays in the plane at right angles are focussed behind the retina (hypermetropia).

(*b*) *Simple myopic astigmatism,* where rays of the one plane are focussed on the retina (normal); rays of the plane at right angles are focussed in front of the retina (myopia).

(*c*) *Compound hypermetropic astigmatism,* where both sets of rays would come to a focus behind the retina, but at different distances behind.

(*d*) *Compound myopic astigmatism,* where both sets of rays come to a focus in front of the retina, but at different distances in front.

(*e*) *Mixed astigmatism,* where one set of rays comes to a focus behind, and the other set in front of the retina.

The compound forms are the commonest. Mixed astigmatism is less common.

12. *Illustrations from Edinburgh and Aberdeen Reports.*

(*a*) *From Edinburgh Report.*

"1. In the consideration of this table, it is important to remember that there is a cardinal distinction between 'normal' in 'acuteness of vision' with both eyes in use, and 'emmetropic,' which means optically normal. A child with a low degree of long sight (hypermetropia) may, by using its accommodation, that is by straining the eyes, read precisely the same print at the same distance

as a child with eyes optically perfect. Both cases would be reckoned 'normal' under the heading 'acuteness of vision.' For the immediate purposes of school life, they would be on an equal footing. But as the child grows older the accommodation becomes less powerful, the defect in the refraction becomes more obvious, and in later life may actually be an obstacle to success in a particular trade or profession. Consequently, the need for spcctacles (or correction) ought rather to be reckoned from the amount and kind of refraction-defect as revealed in each eye by the ophthalmoscope than by the mere result of reading at a given distance with both eyes. Further, a child with one good eye may read the normal type, while the other eye is practically functionlcss. Several cases of this sort were discovered in the course of the examination. One child, seven years old, could read the smallest type on the distance sheet as if her vision were normal; but the right eye was practically useless (being highly hypermetropic). Frequently, when there is this variety of difference between the eyes, squint results. In the particular case there was no squint. The 'acuteness of vision' had to be recorded as normal, although it was normal only for one eye.

"For these reasons the number of 'emmetropic' eyes does not correspond with the number having 'normal' vision reckoned by the 'acutencss of vision.' The percentage with vision requiring correction is, however, reckoned on the reading (or 'acuteness of vision') test alone. The term 'requiring correction' is understood to mean 'requiring correction for school purposes at the time.' The correction necessary to neutralise the optical defect has, however, also been calculated, and the differences in the resulting percentages are somewhat striking. The optical defect is the true test of defective vision. The percentages reckoned in this way are as follows:—

Ages 6 to 9 -	Males, 58 ;	Females, 55·54.
,, 9 to 12 -	Males, 55·44;	Females, 55.
,, 12 to 15 -	Males, 51 ;	Females, 54.
Total, - -	Males, 54·81;	Females, 54·51.

Both, 54·66.

"Reckoned on the basis of the reading test, the percentage requiring correction was, for both sexes, 31 per cent., a little less than a third of the whole. Reckoned on the basis of defects of refraction, the percentage was 54—that is, a little over a half of the whole. This means that 23 per cent., although their eyes were optically defective, could yet use them to obtain normal vision. It ought never to be necessary so to use, or rather abuse, the eyes.

"The precise figure for each eye was ascertained, but it was not considered necessary to record both eyes in the tables. Where one eye was normal and one defective, the child was entered as suffering from the defect of the defective eye. In those marked 'emmetropic,' both eyes were optically normal.

"It will be noticed that the number of hypermetropic or long-sighted children is very much greater than the number of myopic, or short-sighted. This explains how it is possible for the number of those that read 'normally' to be *greater* than the number with *optically* normal eyes.

"2. *Astigmatism.*—Apart from the question of ability to read at the proper distance, astigmatism may cause such discomfort as to affect the health and acquisitive capacity of a child. Over 12 per cent. of the children showed some degree of hypermetropic astigmatism, and some 5 per cent. showed myopic astigmatism. There were a few mixed cases.

"3. *Other Defects.*—Among the 'other diseases' was one extremely marked case of 'conical cornea' of both eyes—an incurable condition, and very difficult to correct even partially. The child was, for reading purposes, almost blind. His education was defective, but his intelligence was good.

"The number of children whose vision had actually been corrected by spectacles was very small.

"4. *Squint.*—There were twenty-six cases of squint. This was in almost all the cases due to long-sightedness (hypermetropia) of one eye. Boys showed a decidedly larger number of cases than girls, there being twenty

cases among boys, as against six among girls. In many instances, the defect, or rather deformity, might have been prevented or improved by treatment at the right time. In several cases, surgical treatment might still produce a distinct improvement.

"The numbers of those that could read at the normal distance were, for the individual schools, as follows:—South Bridge, 93; London Street, 72; North Canongate, 83; Bruntsfield, 87. The differences were not very marked. The numbers with defects of refraction were for the schools taken in the same order, 86, 79, 83, 80. It is thus clear that the defects of refraction are fairly well diffused in all the schools, none showing a great preponderance. This forms a striking contrast to the defects, such as enlarged tonsils or ear diseases, which depend so much on the environment. The ordinary refraction defects of the eye are always congenital, and may be made worse by environment. The general inference, more or less justified by this contrast, is that where the defect is hereditary it must be met by correction of the individual defect; but where it depends on nurture or housing, or other hygienic condition, or improper use, it must be met by preventive measures. In all cases, the conditions of home and school should be such as not to aggravate either inherited or acquired defects.

"5. *Diseases of Eyes.*—There was only one case of conjunctivitis. There were twenty-one cases of corneal ulcers or nebulæ. These are sometimes an index of tubercular disposition. The greater number were found in girls.

"6. *Diseases of Eyelids.*—The principal disease of the eyelids was blepharitis (chronic inflammation of eyelids), including styes. The cases were usually found associated with some defect of refraction. In all, there were thirty such cases. The number of other eyelid diseases was trifling.

"For the individual schools, the numbers of eyelid diseases were as follows:—South Bridge, 14; London Street, 19; North Canongate, 30; Bruntsfield, 16. Here, as in

so many other connections, North Canongate School is worst."

13. *Comparison of Aberdeen and Edinburgh Eye-Defects.*

(b) From Aberdeen Report.

"The proportion of children requiring correction by spectacles for errors of refraction was slightly under one-fourth of the whole of the children examined. In only a few of these had such correction been made, and several of the children were evidently suffering from want of it. The headmaster's attention was drawn to all such cases, with a view to the parents being communicated with. There is obvious need for a regular systematic examination of the eyes of the school children, if the best possible work is to be obtained. The proportion of children with vision requiring correction was slightly higher among girls than boys.

"Diseases of the eye were not common; only 3 to 4 per cent. of the children had affections of the eye, but in several cases the affection was merely a slight and temporary inflammation. A few cases, severe enough to require medical treatment, were evidently not receiving it. Inflammation of the eyelids (blepharitis) was met with in 6 per cent. of the children, and in several instances was in need of treatment.

"Nearly all the cases of eye and eyelid disease met with were remediable."

The following table shows approximate percentages of normal and defective children, classified into three groups of ages. The term normal is applied to those that were able to read D = 6 of Snellen's types at the distance of 6 metres. The term defective was, in Edinburgh, applied to those that could read only D = 9 Snellen and upwards. In Aberdeen, it was applied to those that could read only D = 10 and upwards. Possibly the slight accidental difference in the numbering of the types may have

made a slight difference in the results; but this difference would not affect the results obtained by retinoscopy. These are given in a second table.

ACUTENESS OF VISION: PERCENTAGE OF NORMAL AND DEFECTIVE.

(*a*) *Normal.*

Age Group,	6 to 9		9 to 12		12 to 15		
	Male.	Female.	Male.	Female.	Male.	Female.	Average.
Edinburgh,	65	60	70	70	73	72	68·3
Aberdeen,	84	66	84	84	88	83	81·5

(*b*) *Defective.*

Edinburgh,	35	40	30	30	27	28	31·7
Aberdeen,	16	34	16	16	12	17	18·5

These figures are not entirely confirmed by the results of retinoscopy. If we take the average percentages of refraction defects found in each group of 600 children, we find as follows:—

ERRORS OF REFRACTION.

	Edinburgh.	Aberdeen.
Normal or emmetropia, - -	45·33	43·8
Hypermetropia, - - - -	28·0	36·5
Myopia, - - - - -	6·5	2·7
Astigmatism—		
Hypermetropic, - - -	12·67	13·7
Mixed, - - - - -	2·0	3·0
Myopic, - - - - -	5·5	0·3

In this comparison, Edinburgh children show a greater percentage of normal eyes. Aberdeen shows a decidedly greater percentage of hypermetropia. This doubtless accounts for the fact (see above) that a larger percentage of Aberdeen children were able to read D = 6 Snellen. As we have explained, the hypermetropic child is able to use his accommodation and thus may be able to read as well at a distance as a child whose eyes are optically perfect.

It is noticed that the percentage of hypermetropic and mixed astigmatism is greater in Aberdeen than in Edinburgh. On the other hand, the percentage of myopia and myopic astigmatism is distinctly greater in Edinburgh than in Aberdeen.

If the figures of both tables are carefully examined,

it is found that the percentage of hypermetropia decreases rapidly as the age advances. Thus in Edinburgh, while males of six to nine showed 39 per cent., males of nine to twelve showed only 23 per cent., and males of twelve to fifteen only 22 per cent. The corresponding figures for females were 35, 28, 21. In Aberdeen, the figures for males were 50, 44, 28; for females, 33, 43, 21. Thus, except in the case of Aberdeen females of nine to twelve, the percentage of hypermetropia in both cities rapidly diminishes as the age advances. This is in accordance with results obtained elsewhere.

With myopia, on the other hand, it was different. In Edinburgh, males of six to nine gave 3 per cent.; males of nine to twelve gave 6 per cent.; males of twelve to fifteen, 11 per cent. The corresponding figures for females were 5, 6, 8. In Aberdeen, the corresponding figures were—Males, 0, 2, 3 per cent.; females, 1, 4, 6. In both cities, it is seen that myopia increases with advancing age. This also is in accordance with results obtained elsewhere. It also confirms the statement already quoted that, while hypermetropia is an abnormality, myopia is an acquired disease.

In astigmatism, there is no such marked progressive increase or decrease with age.

CHAPTER XVI.

Examination of the Heart and Circulation.

1. *Introduction.*

In an earlier chapter we have shown that the circulatory system is of paramount importance. We now propose to expound in detail how it is to be examined. In this exposition, we confine ourselves rigidly to those conditions that are most prominent in children of school age. We detail the methods of examination indicated by our experience in the actual handling of 600 school children. The sequence followed is what we found actually the most natural in the conduct of the Edinburgh investigation.

2. *Method and Extent of Examination.*

The method and extent of the examination of large numbers of children depend upon the time available. The object is not to determine a line of remedial treatment, but to ascertain the existence of defects. Accordingly, the full, repeated examination possible in hospital or at home is not called for. The primary medical inspection may, it is true, ultimately lead to a systematic and detailed over-hauling, but in school conditions this is impossible. Nor is it necessary. The vast majority of school children are free from serious abnormalities of the circulation; such defects as a medical inspection in school reveals are sufficient to justify a reference of the child for treatment, or exclusion from school, or careful supervision, and this is all that may properly be asked of medical inspection. The private practitioner will do the rest. In order, however, that the medical inspector should not waste time he should familiarise himself with the heart-conditions of

normal children. He should adopt a definite sequence in his method of examination. He should record on the spot for each individual child the positive or negative result found.

In our examination of the 600 Edinburgh children we adopted the following method:—

Ten to twelve children of ages varying from six to nine years, or nine to twelve years, or twelve to fifteen years, as the case might be, were brought into the room at one time. They were marshalled in a row. If boys, they were told to take off coat and vest and loosen the buttons of the shirt and, where such existed, of the undervest. If girls, they were told to unfasten their bodices and corsets. The boys were usually able to undress themselves sufficiently for the purpose. The older girls were able to assist one another. The younger girls were assisted by women teachers or attendants. All that was wanted was sufficient exposure of the chest to enable the primary examination of heart and lungs to be made and the girth of the chest to be taken above shirt or chemise. In the vast majority of cases, no further undressing was required. In a few cases, where special lesions were discovered, a more detailed examination was made.

These details are mentioned thus precisely in order to reassure those concerned that a medical examination sufficient in careful hands for all the purposes of school inspection may be made with practically no more interference with dress than is necessary for access to the cardiac areas and in special cases to the bases of the lungs, both back and front. Usually the symptoms present gave some hint of the organic conditions to be expected, and the skilled clinical observer will elicit with perfect accuracy all the information he wants almost without any exposure of the chest at all. This is a matter of the greatest practical moment. No medical inspection worth the name can omit the examination of heart and lungs; but the susceptibilities of adolescent girls must at all times be strictly respected, and in competent hands

this can always be done without the sacrifice of any material fact. In this regard there is usually an enormous difference between the delicacy of the experienced consultant, who remembers that his patient is also a human being, and the inexperienced, if equally capable, scientific doctor, to whom a patient is frequently a case and nothing besides.

On the completion of these preparations, the general appearance of the child was noted. Special signs, such as cyanosis (or blueness), clubbed fingers, dilatation of the superficial veins of the neck and chest, were then looked for. Next, the pulse, by which the state of the general circulation is best indicated, was examined for tension, frequency, and regularity. The heart itself was then examined. Auscultation (that is examination with the stethoscope) of the different areas was found to be sufficient. If, after such an examination, any abnormality or organic lesion was detected, a complete examination of the affected system and organ was undertaken. The examination thus proceeded from the more general to the less general and from the less general to the particular. The signs and symptoms noted by inspection formed a check on the examination of the organs involved.

3. *The Heart and Circulation in Children.*

Lesions of the heart in children do not differ essentially from those found in adults, but their occurrence is modified by certain conditions of growth and development. Anatomically, the following peculiarities should be noted:—

(*a*) The apex beat is higher and more to the left than in adults, being often found in the fourth intercostal space or over the fifth rib and external to the nipple line;

(*b*) The cardiac area, on percussion, often seems abnormally large, and caution should be exercised in the framing of any conclusion as to the presence or absence of hypertrophy;

(*c*) The rhythm of the heart is less constantly regular

in children than in adults; very slight causes may disturb the rate and regularity of the pulse, and, accordingly, these two are of little moment as an index of morbid conditions;

(*d*) In rickety children the apex beat may, owing to deformity of the chest, seem to occupy an abnormal position;

(*e*) During childhood, especially between the ages of seven and fifteen, the heart undergoes rapid changes in volume. About the fifteenth year the heart increases in volume by about 100 per cent. (Crandall). This circumstance must be remembered more especially in the prognosis of all cardiac troubles that occur within the ages named.

4. *Abnormal Conditions of the Heart and Circulation.*

Although, as has been indicated, almost any of the cardiac troubles found in adults may be present in boys and girls, we shall here mention only those usually associated with children of school age.

Heart affections in children are conveniently classified into Congenital, Functional, and Organic. The congenital and functional diseases of the heart, though in themselves of less importance than the organic diseases, cannot be lightly regarded, because the congenital diseases necessitate special care and nurture and the functional diseases may be a signal of danger. Accordingly, we give some details of both classes.

5. *Congenital Diseases of the Heart.*

In many cases the congenital defects of the heart are incompatible with separate life, and the child dies very shortly, sometimes a few minutes after birth. In other cases the child may live for months or years, but may fail to reach the school age. In yet other cases, where the congenital defects are not too aggravated, the child may live to school age, but fail to reach adult life. In cases of minor defect he may pass safely through both childhood

and adolescence, but he will probably fail to attain to the vigour of normal manhood. These defects may result (*a*) from defective development; (*b*) from persistence after birth of structures or conditions that are essential to the fœtal circulation; (*c*) from inflammatory disease of the heart (endocarditis) before birth. The defects most commonly met with are—stenosis of the pulmonary orifice and artery, patent ductus arteriosus, patent foramen ovale, and deficiency of the septum between the ventricles. Sometimes several of these conditions are combined. In all, prognosis as regards life is bad, and only in the commonest—stenosis of the pulmonary orifice and artery and slight degrees of patency of the foramen ovale—have the children any chance of reaching adult life.

(*a*) *Stenosis of the Pulmonary Orifice and Artery.*—This is the commonest congenital defect of the heart. If the stenosis is very marked at birth, intense cyanosis (blueness) and embarrassed circulation immediately result, and the child lives only a few hours. In cases that survive childhood, the stenosis has been less marked. A compensatory hypertrophy becomes established, and thus the circulation is carried on. On this hypertrophy depends the prognosis. Only about 16 per cent. survive the twentieth year.

Symptoms.—Subjective symptoms may be absent in those cases where there has been a true hypertrophy. If this has been insufficient, signs of impeded circulation will be present—cyanosis, shortness of breath, palpitation. On auscultation there is heard in the pulmonary area, over the second left space, a harsh systolic murmur not propagated into the vessels of the neck. In the second left space, close to the sternum, there may also be some pulsation and bulging accompanied by a thrill. The area of cardiac dulness, especially to the right, is increased.

(*b*) *Persistent Ductus Arteriosus.*—The symptoms and signs do not very materially differ from those of stenosis of the pulmonary orifice—cyanosis, difficulty of breathing, and hypertrophy of the right side of the heart being among

the chief. Prognosis in this condition is bad. Only a very small proportion live to school age.

(*c*) *Patent Foramen Ovale.*—This condition will sometimes be present without giving rise to any symptoms or physical signs. In minor degrees this defect does not prevent the child from attaining to adult life.

The three conditions named are among the most difficult heart lesions to diagnose. It is frequently impossible to state precisely which lesion is present. The important point, however, is to recognise that the lesion is congenital. The symptoms pointing to this are—a certain degree of permanent cyanosis, frequently clubbing of the fingers, basic position of the murmurs heard.

Prognosis.—Of these three conditions, pulmonary stenosis is the least unfavourable to life. It has to be remembered that such congenital defects render the patients specially liable to fresh endocarditis—a condition more serious in the abnormal than in the normal heart. In such cases, too, pulmonary troubles, even very slight, are of greater gravity, because the circulation at once becomes embarrassed and the compensatory hypertrophy is rapidly lost. It is found that where pulmonary stenosis is present, the patient is peculiarly liable to tuberculosis.

Among the 600 Edinburgh children examined, two cases of congenital heart disease were found—both in young girls, one aged six, and the other aged six and a half. Both patients probably had pulmonary stenosis, but neither had cyanosis, clubbed fingers, shortness of breath or palpitation.

Case I.—Female, aged six. Congenital pulmonary stenosis. Her mental capacity was good; her attendance good. She had two half-hours a week of musical drill. Skipping, balls, &c., were the recorded games. In nutrition she was very thin. She was bright and alert. Her weight was 38·5 lbs. In other respects she appeared healthy. Such a case required medical supervision.

Case II.—Female, six years six months. Congenital affection of pulmonary valves and phthisis of right apex.

This child was of medium mental capacity; pale; unhealthy in appearance; thin; alert; of good carriage. She had a well-marked consolidation of the right apex. Her mother had died of phthisis. There was a congenital affection of the pulmonary valves of the heart. Exercise—dumb-bells twice weekly for fifteen and twenty minutes; skipping and other playground games. This child was quite unfit to be at school and ought to be under medical treatment.

A third case was discovered.

Case III.—Male, ten years five months. Pulmonary valves affected. This boy was excellent in capacity; good in attendance; pale; moderately healthy in appearance; alert. Weight, 61·5 lbs. Exercise—physical drill, half-hour per fortnight. The slight heart affection did not seem to incommode him in any way. There was no indication of excessive exercise.

6. *Functional Affections of the Heart.*

This is the name given to certain heart-conditions that, although obviously morbid, are not accompanied by any anatomical anomaly or gross morbid lesion. They generally occur in children that show other signs of feeble constitution, or that suffer from anæmia, or from some gastric affection. The chief functional affections are technically named arrhythmia (irregularity), tachycardia (rapid heart), bradycardia (slow heart), and palpitation.

(*a*) *Arrhythmia.*—As has been already said, this condition is very easily produced in children. In those liable to it, exercise or any special excitement may at once establish arrhythmia. The rate of the pulse is increased. The irregularity is usually one of time, not of force of beat. On auscultation the first sound of the heart is found to be short and sharp like the second sound.

Various forms of arrhythmia, as shown by pulse tracings, are associated with special organic lesions.

(*b*) *Tachycardia.*—At six years of age, the pulse has

an average rate of 90 per minute. Between ten and fourteen years of age, it has an average rate of 85 to 75 per minute. In nervous children, the rate is very easily accelerated and is sometimes paroxysmal.

(*c*) *Bradycardia.*—It is not common to find the pulse-rate below 60 per minute, but if this low rate should occur and at the same time the pulse be irregular in rhythm, the child's condition demands careful attention. In anæmic children and those suffering from digestive troubles, the pulse-rate tends to be slow.

In the Edinburgh investigation the following cases of functional heart affection were discovered:—

Case IV.—Male, aged ten years six months. Irregular pulse; slight chorea. This boy was excellent in capacity; good in attendance; pale; unhealthy in appearance; thin; alert. Weight, 54·25 lbs. Exercise—physical drill, half-hour per fortnight. This is a case for medical examination.

Case V.—Male, thirteen years two months. Irregular pulse. This boy was excellent in capacity; good in attendance; medium in complexion; good in health appearance; stout; very alert. Weight, 72 lbs. Slight long-sight. Exercise—physical drill, quarter of an hour weekly; football, cricket, swimming. The irregular pulse suggested the probability of over-exertion. This is a case for periodic medical examination.

Case VI.—Male, aged thirteen years and two months. Irregular heart; thumping first sound. This boy was good in mental capacity, medium in complexion, healthy in appearance; stout; very alert. Weight, 88½ lbs. He was admirably developed. He suffered from acute suppuration of the middle ear, with perforation of the drum. This was said to be the result of injudicious bathing at the public baths. His exercises were much the same as in the last case—military drill, half an hour weekly; football, three-quarters of an hour daily; free gymnastics. The violent beating of the heart was painfully manifest,

being quite perceptible at a distance. Possibly the excitement incident to the examination may have accentuated the condition; but this would apply equally to other cases, where no irregularity of pulse or violence of palpitation was found. As in the last case, so in this, the over-exercise had resulted in a disturbed heart, and, no doubt, would, in course of time, produce permanent defects. This boy ought to be under medical supervision.

Case VII.—Male, aged thirteen years and eight months. Irregular heart, second sound accentuated. This boy was recorded as medium in capacity; good in attendance; pale, but not unhealthy in appearance; stout; alert. Weight, 80 lbs.

He had been at drill in the forenoon; he was examined in the afternoon. He was admirably developed, measuring about 5 feet in height. His excrcises were—drill, fifteen minutes weekly; football, half an hour daily; cricket, in summer, one hour weekly. He seemed to be in excellent training; but the irregularity of the pulse clearly indicated that the amount of severe exercise was excessive, and that a continuation of it at the same pitch would ultimately produce serious heart defects. Although the general health seemed excellent, the excessive attention paid to muscular training had resulted in temporary interference with the functions of the heart. This boy's exercises ought to be under skilled supervision.

Case VIII.—Female, aged thirteen years and six months. Irregular heart. This girl suffered from irregularity of the heart. In nutrition stout. Mental capacity good. She weighed 91½ lbs., which was much above the average for girls at that school. Exercise—usual school drill and outdoor exercise.

Case IX.—Female, aged thirteen years and ten months. Functional murmur. This girl was pale in complexion. The heart affection was merely a functional murmur. She occasionally "kept house" for her mother. Attendance

bad. In nutrition she was thin. She also suffered from a dry perforation of the left ear. Tonsils enlarged, adenoids present. This girl was not fit for school work at the time of examination.

It has been suggested that the temporary excitement of the unusual examination was sufficient to account for all these irregularities. For some of them, possibly this explanation is adequate; but for others, it is not. Even if, in the individual cases, the excitement of examination was sufficient to produce irregularity, the question remains why irregularity, and not mere acceleration, should be produced. The fact that irregularity so readily arises suggests that the condition of the heart to begin with is abnormal. Each case must be examined on its merits. Among 600 children it is not likely that excitement should affect in this particular way the hearts of only six unless these six were in some way predisposed to this form of heart-excitement. Thus boys of from ten to thirteen are not normally more easily excited than younger children; yet out of the six cases discovered, four were boys of ten years of age and upwards. Two of the cases were boys that habitually took a great deal of physical exercise and had come to the examination from the physical drill class. The details of these cases show that mere excitement of normal hearts is not enough to account for the phenomena. Irregularities such as those described are always a signal of possible mischief and ought to be followed up accordingly.

7. *Organic or Acquired Affections of the Heart.*

(1) *Age of Occurrence.*—Valvular affections of the heart and affections of the pericardium, though they may occur at any age, are not common in children under five or six years of age. They probably occur oftenest in children of eight to eleven. Among the 600 children examined by us, thirteen cases of organic or acquired heart affection were found. Two of the cases were children under seven years of age; three, children between seven

and nine; three, children between nine and eleven; five, children over eleven. The valve usually affected is the mitral valve.

(2) *Causes of Acquired Heart Disease in Children.*— The causes of acquired heart disease in children are various and sometimes obscure. A very large proportion of the cases, however, are undoubtedly rheumatic in origin. The rheumatic cases are certainly the most important.

Rheumatic affections in children are so varied and uncertain in their manifestations that they are readily overlooked. The features of acute rheumatism (or rheumatic fever), as we know them in adults, are not common in children. The sudden onset, with marked swelling of joints and high temperature, occurs but seldom. What we more commonly find in children is a series of rheumatic affections, insidious in their onset, frequently slight, attacking different organs at the same or different times. Such affections are — tonsilitis, endocarditis, pleurisy, chorea, erythema nodosum, subcutaneous rheumatic nodules, pains in the joints and limbs. Very slight pains in the limbs and joints may accompany an endocarditis, or the endocarditis may precede the joint pains. Between chorea and endocarditis there is a similar close relationship. It is sometimes difficult to decide positively that any of these conditions when occurring singly is rheumatic; but as the existence of rheumatism is of primary importance for prognosis, a rheumatic origin should always be sought for. When a single symptom suggesting rheumatism is found, inquiry ought at once to be made into the co-existence or previous occurrence of any of the other known rheumatic affections. For if a child has once suffered from endocarditis, he is more liable to show another of the rheumatic phenomena. Similarly, subcutaneous rheumatic nodules should always be looked for, because they frequently occur with some one or more of the other rheumatic affections, and they are alone a decisive proof that the child is rheumatic. These subcutaneous nodules are small; they are found over the joints, most commonly over the elbow, and the knee,

sometimes over the ankle joint, sometimes on the ribs, scapulæ, &c. They are not painful; they are not tender on pressure; they are not attached to the skin, nor is the skin over them reddened.

Acute rheumatism, however, is not the only cause of endocarditis in children. Endocarditis may follow scarlet fever, diphtheria, measles, erysipelas, and some other infectious diseases. These diseases may, of course, be complicated by rheumatic conditions, and it is an unsettled point whether so-called scarlatinal rheumatism is a specific sequence of scarlatina or merely an incidental manifestation of rheumatism. Scarlatinal endocarditis must share in this doubt. It is certain, however, that simple endocarditis occurs less frequently in the course of infections than in the course of acute rheumatism, and the prognosis is more favourable.

Symptoms.—In children the symptoms of acute endocarditis are often obscure; the disease may run its course and nothing be suspected. We do not here meet with the oedema of the limbs, enlargement of the liver, and the marked dyspnoea so commonly seen in adults. Slight shortness of breath, slight palpitation, and some vague pains in the joints and limbs may be all the symptoms present. Even very slight pains may be accompanied by a severe endocarditis, and, therefore, when they are present, the heart should always be examined. Among the school children at school, however, it would be a rare exception to find endocarditis in its acute stages. In the cases there discovered, the children have at some period suffered from endocarditis, rheumatic or other, and now show some permanent damage of the cardiac valves. The mitral valve is that chiefly affected, but, in some cases of endocarditis following rheumatism, the aortic cusps may be involved either alone, or in combination with the mitral valve.

In the thirteen cases of organic valvular heart disease discovered among the 600 Edinburgh children examined, seven were cases of mitral incompetence, five of mitral stenosis, one of mitral incompetence and mitral

stenosis. In none of the children examined was the aortic valve involved. One child had evidently suffered from old pericarditis.

Cases of Mitral Incompetence.

CASE X.—Male, aged six years nine months. Mitral incompetence. Good in mental capacity; bad in attendance; pale; bad in health appearance; thin; medium in alertness. Weight, 38·5 lbs. Slightly deaf. Specially noted as—"Slow, dejected, and under-fed." Father lived in a house of one room. Exercise—drill, one hour a week; playground games; marching. This child was not fit to be at school.

CASE XI.—Male, seven years five months. Mitral incompetence. House, two rooms. Good in mental capacity; bad in attendance; pale; unhealthy in appearance; thin; bright and alert. Weight, 40·75 lbs. He suffers also from chronic ear catarrh and perforation of drum. Special note—"Smart, but dirty and badly fed." Exercise, as in Case X. This child was unfit to be at school.

CASE XII.—Male, seven years and six months. Mitral disease; rickets. Dull in mental capacity; pale; unhealthy in appearance; thin; bad in alertness and carriage. Weight, 48½ lbs. Exercise—close drill, hand-bell drill, two half-hours weekly; action songs; football, racing. This child ought to be under medical supervision. The physical exercise described would certainly aggravate his condition. At the time of examination he was unfit for the exercises named.

CASE XIII.—Male, aged nine years five months. Mitral incompetence; irregular pulse. House, three rooms. Excellent in mental capacity and attendance. Medium in complexion, healthy in appearance and nutrition; very alert; good carriage; clean. Weight, 57·5 lbs. Deaf; wax in ears. Exercise—drill, half-hour weekly; football, cricket, walking, swimming. The irregularity of the

pulse indicated that this boy was indulging in excessive muscular exercise. He ought to be under medical supervision.

Case XIV.—Male, ten years eleven months. Mitral incompetence. House, two rooms. Dull in mental capacity; good in attendance; pale; unhealthy in appearance; thin. Weight, 53 lbs. Eyes very defective; internal squint; hypermetropia of both eyes. Suffered from adenoids. Slightly deaf. Retracted membranes. Exercise—as in the last case. This boy was not fit for drill, and ought to be under medical supervision.

Case XV.—Female, aged twelve years and one month. Mitral incompetence, due to rheumatic fever. Suffered from rheumatism from time to time. She was ruddy in complexion, of medium healthiness in appearance, of medium nutrition, of medium mental capacity. Her weight was 71½ lbs. She suffered from myopic astigmatism in one eye and hypermetropia in the other. There was slight retraction of ear-membranes, but no marked deafness. Her physical exercises, as recorded, were—military drill, two half-hours weekly; skipping-ropes; quarter of an hour daily, free gymnastics. This girl ought not to be permitted exercise except under medical supervision.

Case XVI.—Male, aged thirteen years ten months. Mitral incompetence, due to rheumatic fever at age of five. House, two rooms. Medium in mental capacity; perfect in attendance; pale; moderately healthy in appearance; thin; fairly alert. Weight, 54 lbs. Slightly deaf. Enlarged tonsils. Adenoids. Post-cervical glands enlarged. Special note—"Wears no flannel." Exercise—physical and military drill, half-hour weekly; football; cricket; playground games; swimming. This is a case for medical supervision.

Cases of Mitral Stenosis.

Case XVII.—Male, eight years and seven months. Mitral stenosis. This boy was dull in mental capacity;

medium in attendance; irregularly pale in complexion; medium in healthiness of appearance. He suffered from mitral stenosis. He was distinctly defective in hearing. His tonsils were enlarged. His ear-membranes were retracted. He weighed only 40·5 lbs. He was a competent enough child; but he was physiologically disqualified to benefit either by the ordinary school education or by any of the drills or exercises of the school.

Case XVIII.—Male, aged eight years and four months. Mitral stenosis; irregular pulse. Medium in capacity. Ruddy, healthy in appearance; stout; bright and alert; good in carriage. Weight, 61¼ lbs. Hypermetropic. Exercises—same as other infants. This child ought to be under medical supervision. Indiscriminate exercise would aggravate his heart defects. His good muscular condition constitutes a temptation to over-exertion.

Case XIX.—Male, nine years seven months. Mitral stenosis. House, one room. Medium in capacity; medium in complexion; good in health appearance; thin; alert. Weight, 40·5 lbs. Slight deafness; retracted membrane. Exercise—physical drill, half an hour weekly; football; swimming. This boy was diminutive for his age; very spirited and restless. He seemed to suffer no inconvenience from the heart condition. But such a case should be under observation.

Case XX.—Male, thirteen years. Mitral stenosis. This boy was medium in capacity; good in attendance; pale; unhealthy in appearance; thin; medium in alertness. Weight, 58 lbs. Eyesight defective; slightly deaf on account of wax in ear. Exercise—drill, half-hour per fortnight; football; swimming. This is a case for correction of eyesight, examination of ears, and general medical supervision.

Case XXI.—Female, aged fifteen. Mitral stenosis. This girl was dull in mental capacity; good in attendance; pale; medium in health appearance; medium in nutrition.

Weight, 89·25 lbs. Tonsils enlarged. Slight deafness. Exercise—free gymnastics, half-hour weekly. There were no symptoms to indicate that there was any inconvenience from the heart trouble. But such cases should not indulge in exercise without medical direction.

Case of Mitral Stenosis and Incompetence.

CASE XXII.—Female, aged six. Mitral stenosis and mitral incompetence. Irregular pulse. This girl was medium in mental capacity; pale; unhealthy in appearance; and thin. She weighed 42 lbs. She suffered from squint and hypermetropia. She underwent drill two half-hours weekly; drill in class daily, including hand-bell drill, skipping, racing, jingo-ring, &c. She was entirely unfit for such exercise, and probably her heart condition was aggravated by them. She ought to be under medical supervision.

Miscellaneous.

CASE XXIII.—Male, aged ten years and three months. Re-duplicated second sound; chronic inflammation of middle ear. This boy was good in mental capacity; perfect in attendance; pale; medium in health appearance; of medium stoutness. Weight, $55\frac{1}{4}$ lbs. He had chronic inflammation of left middle ear. The exercises recorded were—dumb-bell exercise and boys' games. As "re-duplicated second sound" may indicate failing heart muscle, this boy should be under medical supervision.

CASE XXIV.—Male, aged ten years and five months. Impure first sound. This boy was ruddy in complexion; healthy in appearance; and stout. Weight, 69 lbs. His case was one for observation and supervision. Usual exercises.

CASE XXV.—Male, aged twelve years and eleven months. Old pericarditis. This boy was recorded as excellent in mental capacity. His attendance was "bad," on account of bad health. He was ruddy in complexion; moderately healthy in appearance; stout and alert.

Weight, 72·75 lbs. He was slightly deaf, membranes being retracted. His old pericarditis seemed to give no trouble at the time. His exercises included physical drill, half-hour weekly, and running. The case was one for supervision.

Case XXVI.—Female, aged thirteen years and six months. Impure first sound. In this case the attendance was bad; mental capacity medium; in most other respects, medium or bad. Weight, 68½ lbs. There was chronic otorrhœ of both ears. She also suffered from adenoids and swelling of cervical glands. On the whole, she was unhealthy. Her physical exercises were as in Case XV. She ought to be under medical supervision, both for physical exercise and general health.

8. *Diagnosis of Heart Lesions.*

(*a*) *Mitral Incompetence in Children.*—Mitral incompetence is more frequent than mitral stenosis and, from the standpoint of prognosis, the results are likely to be less severe. The valves on their auricular surface are thickened and shortened. Consequently, the closure during systole of the ventricle is imperfect. On auscultation there is a soft blowing systolic murmur, loudest at the apex and propagated to the left.

(*b*) *Mitral Stenosis.*—Mitral stenosis is almost always rheumatic in origin. In an uncomplicated and well-marked case there is present at the apex beat a rough, pre-systolic murmur terminating abruptly in the first sound. There is little propagation, the murmur being soon lost when traced either to right or left. Re-duplication of the second sound in the pulmonary area or in the third or fourth inter-spaces close to the sternum, is an important confirmation of the diagnosis. A pre-systolic thrill may or may not be present. Loss of compensation is soon followed by pulmonary congestion, and oedema with impeded venous circulation and increased cardiac dulness to the right of the sternum.

(*c*) *Affection of Aortic Valves.*—If these valves are affected in children the affection is always associated with

rheumatism. The left side of the heart gradually becomes enlarged; the apex beat is displaced downwards and to the left; consequently, there is increased cardiac dulness extending to the left.

Pure aortic incompetence is rare in children, and occurs only after severe and extensive endocarditis.

(*d*) *Pericarditis.*—Like endocarditis, pericarditis is often of rheumatic origin. A preliminary affection of the joints may have been entirely absent; the pericarditis and the joint pains may come on simultaneously. Sometimes the pericarditis is preceded by an endocarditis, or a tonsilitis of rheumatic origin. In children, pericarditis may follow certain infectious diseases, being found most commonly after scarlet fever. It may also occur as an extension from pneumonia or pleurisy.

Symptoms.—Pericarditis is very often insidious in onset. It may be accompanied by no local symptoms. It is discovered only after a week or two of general ill-health; it is accompanied by some shortness of breath and pallor. Pain and fever may be absent or very slight.

Physical Signs.—On auscultation there is found a double, creaking, rubbing, or blowing friction sound. This is due to the rubbing of the two inflamed pericardial surfaces on each other. The friction sound is apt to be confused with a double aortic murmur, but the two conditions may be distinguished by an examination of the pulse and of the line of propagation of the murmurs. Further, the pericarditic friction sounds are superficial; in the majority of cases they are best heard over the right ventricle, in the fourth and fifth inter-spaces, near the sternum, and they tend to vary, appearing, disappearing, and reappearing. As the result of pericarditis, chronic adherent pericardium may occur. The result of this is hypertrophy of the heart with some bulging of the chest wall. The apex beat is displaced downwards and to the left. There is systolic retraction of the apex beat, with a diastolic rebound and diastolic emptying of the cervical veins. There is also an increased area of cardiac dulness, especially upwards. There may be no endocardial murmurs, but the pulse is often irregular.

Among the 600 children examined was found one case of old pericarditis in a rheumatic boy. (Case XXV.)

9. *Prognosis in Organic Heart Affections.*

In a case of recent endocarditis the immediate prognosis is fairly good. Ultimate prognosis is intimately related to the causation of the condition. If the endocarditis in the particular case is non-rheumatic, the resulting damage is not so severe and recurrence is not common. If the endocarditis is rheumatic in origin (and most cases are), the liability to recurrence or fresh infection is considerable, and to a great extent depends on the care taken to avert a second attack. In children at school and able for school work, compensation must have been established, and thus the circulation is carried on effectively. But in cases of cardiac affection, the final years of school life are the most critical, for with the changes that naturally take place in the heart at this period, the established compensation is very readily broken down.

Among the special conditions, a pure mitral incompetence in an otherwise healthy, vigorous child presents a most favourable prognosis. This is still more favourable if a further rheumatic attack can be warded off. Mitral stenosis is more serious. With the pulmonary circulation more or less impeded, the child is liable to suffer from bronchitis and congestion of the lungs, and this is followed by a rapid failure of compensation.

10. *Treatment.*

The condition should be brought to the knowledge both of parent and teacher. The child's work and exercise both in kind and amount should be carefully directed and supervised. Violent exercises must be prohibited. Outdoor recreation, however, is essential. Confinement interferes with the child's nutrition, anæmia results, and in that condition the compensation is extremely liable to break down. The diet should be generous, the clothing should be warm, flannel should be worn both in summer and winter. If compensation does break down, entire rest for a prolonged period is absolutely necessary.

CHAPTER XVII.

Examination of Lungs and Respiration.

1. *Measurement of Chest, and General Inspection.*

Detailed directions for the measurement of the chest are given in the Notes to Schedule B (Appendix II.). In very young children, breathing is diaphragmatic (Goodhart); hence there is difficulty in detecting the movements of the upper parts of the chest. The breathing, too, is frequently irregular. It stops, and then suddenly there is a deep inspiration, or sigh. Accordingly, the chest measurements cannot always be properly divided into "deepest inspiration," "deepest expiration," and "counting ten." These categories must frequently be reserved for the older children, whose nerve-mechanism of respiration is more stable and more highly educated.

Defects in development and shape should be carefully recorded.

2. *Phthisis.*

That phthisis occurs among school children it is unnecessary to prove. That it is frequently implanted at school to be developed in later life, is highly probable. That enlarged cervical glands prepare the way for it is certain. The enlargement of these glands may result from vermin in the hair, inflamed tonsils, carious teeth, and many other varieties of inflammation or infection. But whatever be the cause of their enlargement, they always remain a possible medium for the growth of the tubercle bacillus.

In children, phthisis manifests itself most frequently at the apex of the right lung.

The physical signs to be looked for are the same as in

adults. But normally, in children, the breathing is much harsher and the inspiration is always longer than in adults. Further, at the right apex the ordinary breath sounds, vocal fremitus, &c., are always more pronounced than at the left apex. Of physical signs probably the most authentic are the fine crepitations heard at the end of deep inspiration.

It is always important to inquire into the family history.

In cases of chronic bronchitis in children, it is important to examine for any signs of tuberculosis. Similarly, in cases of recorded pleurisy.

Phthisis is so common and so universally studied that the importance of general symptoms is well understood. Dr. R. W. Philip lays great stress on the pulse and vascular condition generally. The whole nutrition should be carefully estimated. The various types of tubercular diathesis are easily picked out in any school. The children with any delicacy of skin should receive special attention.

The following series of cases discovered among the Edinburgh and Aberdeen school children (14 cases in 600 Edinburgh children; 3 cases in 600 Aberdeen children) will illustrate, in the concrete, some of the varieties to be expected.

(*a*) *From Edinburgh Report.*

(Cases arranged in order of Age.)

Case I.—Male, six years four months. Phthisis. Mental capacity excellent; attendance good; complexion pale; health appearance medium; in nutrition stout; very alert. Weight, 43 lbs. Eyes slightly myopic. Exercise—drill, dumb-bells, two half-hours weekly, football, outdoor games. The right apex had distinct signs of incipient phthisis. This child should have been under treatment.

Case II.—Female, aged six years six months. Phthisis and pulmonary stenosis. Already described as Case II. in Heart series.

CASE III.—Male, six years ten months. Phthisis. House, three rooms. Mental capacity medium; attendance bad, owing to father's holidays; pale; health appearance medium; thin; moderately alert. Weight, 50 lbs. Tonsils enlarged. Adenoids. Eyes slightly hypermetropic and astigmatic blepharitis. Exercise—dumb-bell drill, twice weekly, usual games. This boy should be under treatment for incipient phthisis.

CASE IV.—Male, seven years four months. Phthisis. Mental capacity excellent, attendance good; complexion medium; health appearance medium; in nutrition medium; alert. Weight, 50·5 lbs. Slightly hypermetropic. Cicatrices of suppurating glands in neck, recent. Phthisis of right apex. Exercise—as in Cases I. and III. This child should be under medical treatment. He might become a source of infection to other children.

CASE V.—Female, eight years one month. Phthisis. House, one room. This girl was dull in mental capacity; medium in attendance; medium in complexion, in health appearance, in nutrition. Weight, 49·5 lbs. Slight deafness in one ear. *Special note*—"Badly sent out." Neither clothing nor body was clean. Eyesight slightly defective. There was consolidation of the right apex. This child ought to be under medical treatment.

CASE VI.—Male, nine years two months. Phthisis, left apex. Pneumonia. Temperature, 102° Fahr. Mental capacity medium; attendance perfect; pale; bad health appearance; thin; moderately alert. Weight, 50 lbs. Slightly deaf. Adenoids. Distinct phthisis of left apex. Pneumonia developing. This child is quite unfit to be at school. Slow in action. Exercises—marching and free exercises, half an hour a week.

CASE VII.—Female, nine years seven months. Phthisis. Mental capacity excellent; attendance good; ruddy; medium in health appearance; medium in nutri-

tion; extremely bright and alert. Weight, 56 lbs. Slight deafness of one ear. Right apex distinctly consolidated. Exercise—drill, half-hour per fortnight; swimming, skipping, walking, and other outdoor exercises. This child, if continued at school, may at any time grow rapidly worse. Under treatment she may recover.

Case VIII.—Female, nine years seven months. Phthisis. House, four rooms. Mental capacity good; attendance good; complexion ruddy; healthy in appearance; moderately well nourished; moderately alert. Weight, 52 lbs. Hearing defective; eyes slightly defective; well-marked phthisis, with moist sounds. This girl ought to be under treatment.

Case IX.—Female, eleven years five months. Phthisis. Mental capacity medium; attendance good; complexion ruddy; health appearance medium; stout; alert. Weight, 73 lbs. This is excessive weight for the age. Neck glands affected. Exercise—no gymnastics; usual school games and drill. Phthisical condition of lungs well marked. This girl ought to be under treatment.

Case X.—Male, eleven years seven months. Phthisis. Mental capacity good; attendance good; complexion medium; health appearance medium; thin; alert. Weight, 76 lbs. Exercise—drill, half-hour per fortnight; football. Phthisis established in right apex. This child should be under treatment and not at school.

Case XI.—Female, twelve years two months. Phthisis. House, two rooms. Mental capacity good; attendance medium; pale; moderately healthy in appearance; medium in nutrition; alert. Weight, 60·78 lbs. Enlarged tonsils. Glands in neck swollen; old operation. Incipient phthisis in right apex. Exercise—military drill, half-hour weekly; skipping, free gymnastics. This girl ought to be under medical treatment. Exercise should be under strict medical control, otherwise the disease will

advance rapidly. *Special note*—"Best teeth seen yet"—that is, after over 400 examinations.

Case XII.—Male, twelve years three months. Phthisis. Mental capacity good; attendance good; pale; medium in health appearance; thin; alert. Weight, 68 lbs. Slight deafness, due to retracted membranes; adenoids; right apex affected. Exercise—drill, half-hour weekly; free gymnastics; football; Boys' Brigade. This boy ought to be under medical treatment.

Case XIII.—Male, thirteen years five months. Phthisis. This boy was medium in capacity; good in attendance; ruddy; healthy in appearance; stout; alert; good carriage. Weight, 93 lbs. In every respect well developed. Exercise—including drill, half-hour weekly; football, half-hour daily; free gymnastics. There was nothing to indicate that the exercise was excessive; but the boy ought to be under medical treatment in case the disease should develop rapidly.

Case XIV.—Female, thirteen years eight months. Phthisis. House, three rooms. Mental capacity good; attendance good; pale; medium in health appearance; medium in nutrition; alert. Weight, 89·5 lbs. Incipient phthisis of right apex. Exercise—free gymnastics, one hour weekly; usual outdoor games. This case should be under treatment.

In the school where it occurred, Case XIV. was the solitary case of phthisis. It may be suggested that one factor to account for the small amount of phthisis in this school of very poor, under-fed, and badly-housed children, is the early death of feeble infants in this quarter of the city.

The four cases—V., XI., XII., XIII.—were at one school. The striking feature is the co-existence of incipient phthisis with good, or even excellent, physique. This confirms the general contention that no violent

exercises should be practised without preliminary and periodic medical examination.

In one school, six extra cases were examined, all boys. These are not reckoned in the tables. Among them was found one boy, aged thirteen years three months, with incipient phthisis of the right apex. He had had rheumatic fever two months previously. He was pigeon-chested. He was good in capacity, regular in attendance, medium in complexion and healthiness of aspect, stout. Weight, 104 lbs. Exercise—no gymnastics, but physical drill and swimming. This boy was over the height and weight appropriate to his age. He ought to be, and probably was, under medical supervision.

(*b*) *From Aberdeen Report.*

"*Diseases of Lungs.*—In males—Bronchitis, 5. In females—Bronchitis, 3; consolidated apex, 3. The cases of consolidated apex were probably cases of incipient phthisis. They were not, so far as could be ascertained, receiving medical attention."

3. *Other Diseases.*

The other leading diseases of the chest are all more acute than phthisis, and are not likely to be found common among children at school. Chronic bronchitis may be discovered, but pneumonia, acute bronchitis, acute pleurisy, and empyema are certain to be comparatively rare. When any symptoms of these diseases supervene, the children are unfit for school and are usually kept at home. In one case, however, among the 600 Edinburgh children, a boy with beginning pneumonia (temperature 102° F.) was found still at school, apparently without having attracted the teacher's attention.

The following cases of bronchitis were found among Edinburgh children:—

Case I.—Male, six years and four months. Bronchitis. House, three rooms. This boy was excellent in capacity;

medium in attendance; irregularity due to illness; pale; unhealthy in appearance; thin; very alert; good carriage. Weight, 44 lbs. Slight enlargement of tonsils. This boy was unfit to be at school.

Case II.—Female, seven years and seven months. Bronchitis. House, two rooms. Very dull child. Attendance good. Pale; unhealthy in appearance; thin. Weight, 35 lbs. Slightly deaf. Body not clean. *Special note*—"Very dull, under-fed, poor hair." Exercise—drill, one hour weekly; running, skipping, marching. This child was quite unfit to be attending school.

Case III.—Male, eleven years. Bronchitis. Mental capacity good; attendance medium; moderately alert; slightly deaf; tonsils enlarged; adenoids. *Special note*—"Very depressed." Bronchitis well-marked. Exercise—drill, half-hour per fortnight; usual school games. This child, at the time of examination, was quite unfit to be at school.

Case IV.—Male, eleven years and seven months. Chronic bronchitis. Mental capacity good; attendance perfect; medium in complexion; healthy in appearance; stout; alert. Enlarged tonsils. Nebulae on cornea. Weight, 74 lbs. Usual playground games. Ought to be under medical supervision. The boy seemed adapted to his chronic trouble; but will be handicapped for life.

In Aberdeen, as noted above, 8 cases of bronchitis were discovered. It is probable that some of these bronchitis cases, both in Edinburgh and Aberdeen, were really cases of phthisis.

CHAPTER XVIII.

Examination of the Skin.

1. *General.*

Here we deal only with the skin diseases likely to be found in children attending school. The majority of those diseases are contagious. Almost all of them are likely to be found only in city schools that draw on the lowest classes of the population. These diseases are the natural consequence of the overcrowding, uncleanliness, and insanitary environment.

2. *Impetigo Contagiosa.*

This is an acute contagious skin affection, occurring most commonly among children that live in a densely populated area. It spreads rapidly. In a short time, it may affect a whole household or a whole school. Its causation has not been definitely ascertained. Various fungi have been found in the crusts.

Appearances.—It occurs most frequently on the face, affecting particularly the chin and the angles of the mouth. Unless vigorously treated, it rapidly spreads by auto-infection. The hands and head, too, are often attacked. First there appear vesicles, surrounded by a slight redness. These vary in size; they contain serous liquid, which in a day or two becomes sero-purulent. The vesicles then dry up and become yellowish, granular crusts, which are not firmly attached to the underlying skin. There is no itching.

Treatment.—The disease runs a course that depends entirely on treatment. If it is untreated, one patch leads to another until the whole face is affected. But under

treatment, the disease can be cured in a few days. The crusts are, if necessary, softened by poulticing; they then readily drop off or can be removed by picking. Some preparation of mercury is then applied to the skin surface. To prevent the spread of infection to other children, the affected child should be removed from school for a day or two and the parents should be informed that the condition is contagious.

3. *Tinea Favosa or Favus.*

This disease is due to a vegetable parasite—the achorion Schoenleinii. Any portion of the general skin surfaces of the body may be attacked, but the disease commonly appears on the scalp. It attacks and invades the root sheaths of the hair.

Appearances.—At first the lesions appear as reddish scaly patches, soon followed by the typical crusts. These consist of sulphur-coloured, cup-shaped masses, raised somewhat above the scalp and showing a hair in the centre, which is depressed. As the cup-shaped masses grow, they fuse with one another and form greyish crusts. These emit a peculiar mouse-like odour, which is unmistakable. The hairs of the affected part are damaged. They become dry and brittle, they fall out, and if the disease be not checked, the hair follicle decays and permanent baldness follows. The disease is difficult to cure and is apt to recur.

If a portion of the crusts, or a hair, be soaked in liquor potassae and examined under a microscope, the fungus is seen to consist of a branching mycelium made up of short jointed rods, with spores, either in rows or in groups.

Treatment.—Children suffering from favus should be excluded from school until the condition is entirely cured.

4. *Tinea Trichophytina or Ring-worm.*

Ring-worm, like favus, is due to a fungus that grows on the skin or hair. When it attacks the hair, it produces the condition known as tinea tonsurans, or ring-worm of the scalp. When it attacks the skin, it produces tinea

circinata, or ring-worm of the body. In a case suffering from ring-worm, the fungus may be found if a hair is soaked in liquor potassae and then pressed out between a slide and cover-glass and examined under the microscope. The fungus consists of a branching mycelium, smooth-bordered and with spores, which are about half the size of the favus spores and are arranged in groups or chains.

Appearances.—Ring-worm starts as a small red scaly spot. This gradually spreads at the margin and heals in the centre. Thus there is formed a ring of small raised papules, encircling an area of healthy skin. This appearance probably gives rise to the name ring-worm. The disease may continue to spread indefinitely, the ring growing larger and larger. But usually after a time it ceases to spread and remains stationary. Several circular patches frequently coalesce and form irregular disease areas over the scalp. The hairs that project through the area affected become very brittle, they are bent and twisted and their ends are frayed out. They break off short. If untreated the disease may last indefinitely and result in permanent loss of hair over the affected area.

The diagnosis should always be verified by the microscope.

Treatment.—The treatment required is entirely local. The hairs surrounding the affected area should be cut short. The hairs within the area should be plucked out, hair by hair. The condition may then be checked by the vigorous application of tincture of iodine, salicylic acid, or ammoniated mercury. In chronic cases, a more severe irritation may be necessary, such as is produced by croton oil.

Ring-worm is contagious from child to child. Children affected with it should, therefore, be removed from school and not permitted to return until the disease is cured.

5. *Certificates of Cure.*

"The medical attendant is sometimes asked for a certificate that the case is cured, so that the patient may go to school or enter some public institution. This is a matter

which incurs responsibility, and, in the event of an error, gives rise to such mortification and unpleasantness all round. It is no easy thing sometimes to say positively that a ring-worm of the scalp is cured. Careful search should be made with a lens for diseased stumps, and if any suspicious hairs should be discovered, they should be examined microscopically. Slight scaliness in patches is suspicious. In a cured case the new hair grows evenly and regularly and has a characteristic set. When there is any doubt, the signing of the certificate should be deferred, and an ointment used occasionally as explained under treatment. It is important to be able to say 'no' firmly, for parents get restive, and naturally so, after a long and tedious course of treatment."—(George Pernett, M.R.C.S., in Green's "Encyclopædia Medica.")

6. *Scabies* (*Itch*).

This disease is due to an animal parasite, the acarus scabiei, or itch mite. The male acarus remains on the surface of the skin. The female burrows under the epidermis to lay her eggs, choosing for this purpose some portion where the epidermis is thin—for example, between the roots of the fingers, in the flexures of the wrist or elbows, the axilla, &c.

Appearances.—The lesions caused in the skin by this parasite are multiple, some being due to the burrows containing female acarus, others being the result of the scratching induced by the intense itching. The burrow, which is not always easily discovered, is indicated by a short, fine, dark line on the portions of the skin mentioned. The scratching results in papules, vesicles, pustules, and crusts, which tend to conceal the burrows.

The characteristic symptom is the intense itching.

For diagnosis, an attempt should be made to obtain the female acarus from the deeper end of her burrow. Under the microscope, she is seen to possess four pairs of legs, the two anterior having suckers, the two posterior ending in bristles.

Treatment.—The condition is readily cured under

proper treatment. Hot baths, with free application of green soap and thorough rubbing should precede any local application. This is followed by the rubbing in of sulphur ointment over the affected regions.

Scabies is contagious. Probably, it is most frequently conveyed by garments that have become infected, or by infected bed-clothing. When a case has been treated, the clothing must also be disinfected, otherwise it will give rise to a recurrence of the disease. Scabies is found among filthy and infrequently bathed children.

7. *Pediculosis.*

Of the three species of lice that occur as parasites on the human body, two—the pediculus capitis and the pediculus corporis—occur in children. The pediculus capitis is most common.

The pediculus capitis, or head louse, may occur in all classes of children, but is common among the poorer and less well attended. The louse is found among the hair. The eggs, or nits, appear as small white specks, attached to the side of the hair, each hair showing two or three nits. As a result of the scratching due to the irritation of the parasite, there occurs a superficial inflammation of the skin—(dermatitis),—scattered, or numerous pustules matting the hair together. The posterior occipital glands then become enlarged and tender, and may suppurate.

Treatment.—The hair should be cut short. The crusts should, if necessary, be softened by poulticing and then removed. The head should be thoroughly soaked at night with petroleum, which should be washed out in the morning with soap and water. Two or three applications are usually sufficient.

Pediculosis is contagious. The exchange of caps or other articles of clothing may be a means of conveyance.

8. *Alopecia Areata.*

This is a name given to a certain form of baldness where the hair is lost over one or more areas of the skin. The baldness is not often general. It takes the form of

white, smooth, glistening patches, which vary in size from a shilling to half a crown or larger. It is essentially chronic, lasting for months or even years. It may follow some severe illness; but often it appears with no definite apparent cause. By some pathologists, it is regarded as contagious. By others, it is regarded as a trophic condition. Spontaneous recovery usually takes place, the hairs gradually returning.

It has to be carefully distinguished from ring-worm.

Children suffering from alopecia areata do not need to be excluded from school on that account alone.

9. *Herpes Zoster (Shingles), Facialis, Frontalis, Labialis.*

Herpes is an acute inflammatory condition of the skin characterised by the presence of minute vesicles along the course of the sensory nerves. It is very common in children. It is probably infectious. It is most prevalent in spring and autumn. It may appear along the course of almost any sensory nerve, and according to position is named frontalis, facialis, labialis, &c.

Symptoms.—For a day or two before the vesicles appear, the child feels ill and out of sorts. There may be some fever and gastro-intestinal disturbance. Along the course of the affected nerve there is considerable pain. This usually diminishes when the vesicles appear. In size, these vary from a pin-head to a pea. At first, they are filled with serous liquid, which then becomes purulent. They ultimately dry up and form a brown crust. This falls off and leaves a reddish surface.

10. *Eczema.*

Eczema is the most common skin disease occurring in children. The majority of cases occur in children under five years of age. The appearances vary from simple scaliness to red, moist, "weeping" surfaces. In some forms, it is contagious.

11. *Psoriasis.*

Psoriasis is a chronic inflammatory condition of the

skin. The leading feature of it is dry, reddish scaliness. It is not contagious. The affected children may, without danger of infection, be allowed to mix freely with others.

12. *Erythema Nodosum.*

Erythematous eruptions of the skin are common in children. As already mentioned, erythema nodosum occurs in rheumatic children and is accordingly important. It may also occur, however, in children suffering from alimentary troubles.

Appearances.—The disease consists of isolated, rounded, raised nodules of varying size. They are hard, tense, red, very painful, tender on the touch. They resemble bruises so much that they are sometimes mistaken for these. They last a few days and then decline. As they disappear, they go through the various colours of a recovering bruise.

Their presence is no index of an infectious condition, but, for other reasons, the child should be kept from school.

13. *Conclusion.*

These are only a few leading skin diseases. The skin is affected in most of the infectious fevers, *e.g.*, measles, scarlet fever, &c. All children whose skins are in any way seriously affected should be marked by the teacher for medical inspection. Ring-worm, favus, and scabies are the most troublesome at school. Children affected with them should be segregated; their clothing, caps, bags, books, &c., should be thoroughly disinfected. The school where these diseases occur or recur should be disinfected.

CHAPTER XIX.

Examination of the Nervous System.

1. *Diseases of Nervous System.*

Were we to deal exhaustively with the relation of school life to nervous diseases, we should have space for nothing else. The nervous system of the growing child is the cardinal physiological system of the educational life. Every other system subserves it. Every step in progress is a manifestation of nervous growth. Nutrition, growth in general, height, weight, heart-conditions, lung-conditions, muscular-conditions, briefly the whole system of organic structures are in the broad sense "functions" of the nervous system. But just because the nervous system is fundamental, the diseases of it do not play a very prominent part in the ordinary day-school. The nervously-diseased child is largely eliminated from school. If he suffers, he suffers very often from diseases not obviously and apparently nervous. Acute nervous diseases are, as a rule, too serious to be neglected even for a short time. Meningitis, when it occurs, demands the instant attention of the physician. Infantile paralysis will, as a rule, have supervened before the school-age. Paralysis following diphtheria ought not to be present in children at school; but it should be kept in view as a possibility in cases of squint, or defective gait, or the like. The history will be easily verified from other observations and inquiries. Minor nervous diseases, due to deformities or injuries, are likely to be rare. But there are at least two varieties of nervous disease, or rather symptoms, that are relatively common among children at school, and always demand serious inquiry. We mean headache and chorea or St. Vitus' dance.

2. *Headache.*

Among children generally, and school children in particular, headaches occur with great frequency. They are, it is true, only a symptom in the course of some functional, or organic, or specific disease, but they interfere directly with the school efficiency of the child. They are often the only symptom elicited to account for the child's failure to perform the routine school work. Here it is enough to indicate the common conditions that may have headache as the chief, it may be, the only symptom.

(*a*) *Headaches from Eye-work.*—Where the eyes are hypermetropic, or astigmatic, their constant occupation with near work—reading, sewing, drawing, &c.—may give rise to recurrent and persistent headaches. This is a common cause of headache among school children. The large proportion of optically defective eyes leads us to expect no less. The remedy is obvious—correct the optical defect. But the fact that the defects are so widespread suggests a basis for the persistent allegation of "nervous over-strain" — over-pressure — at school. Nervous over-strain is a very probable consequence when the eyes are defective, and headache is the danger signal.

(*b*) *Headache from Nasal Catarrh.*—Nasal catarrh is, as we have seen, one of the commonest diseases of children. The nasal passages are the first to suffer from changes of climate, from in-drawn dust, from infection of many varieties. The resulting congestion may result in headache. The examination of nose and throat will reveal the cause.

(*c*) *Headache from Dyspepsia.*—Where neither eye nor nose affords evidence of reflex irritation, the condition of the stomach should be investigated. The nutrition of the child will give some indication. The tongue should be examined. But in all such doubtful cases, the throat—tonsils and pharynx—should receive special attention. The temperature and pulse should be taken. The headache apparently due to dyspepsia may be the index of on-coming measles, scarlet fever, diphtheria, enteric fever, ton-

silitis, pneumonia, small-pox, chicken-pox, or other acute disease.

(*d*) *Headache from Decayed Teeth.*—The dyspeptic child usually suffers, disproportionately, from decayed teeth. These may give rise to headaches. They may lead to abscesses in the gum, with general rise of temperature.

(*e*) *Headache from Bad Environment.*—Children that are improperly fed, badly nourished, and housed in bad hygienic environment, are more liable to headache than normally-fed children. In these cases, the headache is a symptom of general mal-nutrition, which may be the product of many factors.

(*f*) *Headache from Anæmia and Rheumatism.*—Anæmic children of rheumatic tendencies may suffer from constant headaches. Children that actually suffer from rheumatism are extremely likely to manifest headaches.

(*g*) *Headache in Neurotic Children.*—Children of neurotic parentage and individually neurotic children are likely to suffer from headache. The term "neurotic" is somewhat vague, but it is meant to indicate generally the child of unstable nervous history. For example, the child of insane or nervously defective parents, or a child ill-nourished and nervously undeveloped, might be "neurotic." The nervous instability would, in many cases, first appear in the form of headaches.

(*h*) *Headaches of the Unstable Ages.*—At the onset of puberty, especially in girls, headaches may become very pronounced and constant.

(*i*) *Headache from Bad School Conditions—Overcrowding, &c.*—It must not be forgotten that a normal result of overcrowding and bad ventilation is headache. The school conditions should always be eliminated in the investigation of headaches. Usually teachers as well as children will complain, and evidence is soon forthcoming.

3. *Chorea, or St. Vitus' Dance.*

(*a*) *Physical Signs and Symptoms.*—Of serious nervous diseases, chorea is probably the most common among school

children. It is characterised by rapid, incontrollable twitchings of some or all of the muscles of the body. It occurs most frequently between the ages of seven years and twenty years. This includes at least three-fourths of the school-age.

The muscular twitchings may be limited to the face, or a limb, or one side of the body, or may be general. They are always intensified by excitement, by the directing of attention to the child, or by any voluntary effort on his part. Increased self-consciousness is invariably accompanied by increased twitchings.

When the face is affected, the child makes queer grimaces, the lips twitch, the nose is screwed up, the eyes blink. He is continually "making faces." When asked to put out his tongue, he puts it out with difficulty, keeps it out only for an instant and then withdraws it with a sudden jerk, the mouth closing like a rat-trap. The speech is thus often affected.

When the arms or legs are affected, there appear irregular, purposeless free movements of the fingers, hands, arms, legs. The gait is jerky and inconstant. The child is restless. He cannot maintain any posture for more than a few seconds. In slight cases, the symptoms may show themselves by awkwardness in performing ordinary movements; for example, in the movements of writing, drawing, or free gymnastics. Wherever any directed voluntary action is required, there a slight functional irregularity is manifested.

(*b*) *Mental Symptoms.*—Mentally, the choreic child is very irritable. He is restless. He cannot concentrate his attention for any considerable time. He is easily made angry; he is easily depressed; he is quarrelsome. He is quite unfit for school work. Any such change of manner, with irritability and restlessness, should excite the teacher's suspicion. The child should be at once set aside for medical examination.

(*c*) *Duration.*—The condition lasts, as a rule, for ten to twelve weeks. For the first two or three weeks, it increases in severity. Then it decreases, the twitchings subsiding gradually.

(*d*) *Causes of Chorea.*—Rheumatism is a common cause, especially where there has been endocarditis or pericarditis. Apart from rheumatism, however, the heart is frequently found affected in chorea. Heart-murmurs are present. Sometimes chorea follows the acute fevers—scarlet fever, measles, whooping-cough. Sometimes it supervenes suddenly as the result of fright or shock. Sometimes it results from decayed teeth.

(*e*) *Importance of Early Diagnosis.*—Children that suffer from any degree of chorea are absolutely unfit to continue school work. This should be an unconditional rule of practice. Chorea is a disturbance of the central nervous system. It is an evidence of a serious condition. It should be the signal for reducing all nerve-stress to the lowest possible point. And its recognition in the earlier stages is of primary importance. Otherwise, children that are apparently only inattentive, but are really ill, may be subjected to great severities of discipline when they ought to be in the hands of the doctor. They appear careless; they may be morbidly careful. They appear inattentive; they may be striving to attend. They appear awkward in movement; they may be straining after precision. They should be freed from the exactions of school. They should not return until the condition has absolutely passed away. It tends, however, to recur. And then it should be treated as before.

4. *Over-pressure.*

The question of "over-pressure" is really a question of nerve-strain. The medical inspector will estimate this from his total examination of the child, not from a single condition. "Over-pressure" is so very vague a category that, in practice, it is of very little value. It must be tested by the detailed gauging of each sense, each organ, each peculiarity; nutrition; vigour, &c. Every system must be carefully examined. The time assigned to work, the time to play, the time to exercise, the food, the time of feeding, the school hygiene—all these are factors in over-pressure. When all these conditions of nervous

nutrition and growth are carefully investigated, the term "over-pressure" becomes capable of an exact meaning. Food, housing, and occupation will assume a real importance. The relation of the school-life to the non-school-life will be better understood. It will, in many cases, be discovered that the true cause of over-pressure is underfeeding and defective home-nurture.

CHAPTER XX.

Examination of Glands, Bones, Joints, Deformities.

1. *Glands.*

In the examination of school children the condition of the lymphatic glands is of the greatest importance.

The principal groups of glands to be examined in every child are the occipital, which are situated on the origin of the trapezius; the internal maxillary, situated "on the posterior part of the buccinator muscle and side wall of the pharynx"; the posterior auricular; sub-maxillary; superficial cervical, situated "on the upper lateral parts of the neck, in front of the sterno-mastoid along the external jugular vein"; deep cervical; axillary; popliteal; inguinal. All these it is possible to examine at school.

Dr. Lovell Gulland remarks—"In children, enlargement of the occipital glands should always indicate examination of the scalp for suppurative processes and for pediculi; enlargement of the internal maxillary glands, almost invariably associated with that of the deep superior cervical, is a strong presumption in favour of the presence of adenoids."

In the same article, he writes—"Manfredi also found that he could introduce small numbers of such organisms as bacillus prodigiosus and anthracis through the skin by producing slight irritation, and that the nearest glands contained the organisms in a virulent state for four or five days, and in a less virulent condition for several days longer, while the rest of the animals remained sterile and unaffected. If an organism of such rapid growth as the anthrax bacillus can remain latent for so long, it is not to be wondered at that slow-growing organisms like the

tubercle bacillus may be latent for vastly longer periods, and that a forgotten gland in the neck may give rise at last to miliary tuberculosis."—(" Encyclopædia Medica," art. on *Lymphatic System.*)

2. *Bones.*

As with most other structures, so with bones—only the chronic diseases are likely to be found with any frequency in school children at school. The reason is obvious. The acute bone diseases are usually disabling; they make school attendance impossible. When the child becomes a cripple, he is permanently withdrawn from the ordinary elementary school. He may or he may not be otherwise provided for; but he generally ceases to be a problem for the medical inspector. In London, Glasgow, and some other places, schools for cripples have been organised. That they should be under medical supervision goes without saying. Medical inspection of the ordinary elementary schools will probably result in the elimination of a certain additional number of cripples.

The two diseases that contribute most to the bone diseases or bone deformities of school children are tuberculosis and rickets. It is, however, well to remember that many forms of chronic bone disease may be due to pus-producing organisms. Without special bacteriological investigation, these forms frequently cannot be distinguished from the tubercular bones. At school, the medical inspector cannot always complete the diagnosis; he must be content to make a provisional classification. Among diseases due to infection by pus-producing organisms, which, however, may not always produce pus, Dr. Alexis Thomson enumerates these—acute suppurative osteomyelitis, periostitis, epiphysitis, chronic abscess of bone—all accompanied by formation of pus; "growth fever, hyperostosis, sclerosis, quiet necrosis, serous or albuminous forms of periostitis and osteomyelitis, certain bone cysts, and probably also the inflammation of bone associated with acute rheumatism."—(" Encyl. Med.," art. *Bone.*)

The chronic results of some of these diseases may be met with at school.

Tuberculosis may take the forms of tuberculous periostitis and tuberculous osteomyoelitis.

Tuberculous periostitis leads to "cold abscesses." When these burst, a "sinus," passing from the surface of the skin down to the bone, is left. This may be the only obvious sign of bone disease.

Tubercular osteomyelitis may reveal itself only by the occurrence of some deformity, as curvature of the spine.

The possibility of other infections must always be kept in view. The general condition of the child will confirm, or not, the diagnosis of tubercle.

Rickets occurs most commonly among the badly fed, the incorrectly fed, the badly housed. Many hypotheses as to the causation of it have been put forward, but none of them holds the field. The hypothesis now growing in favour is that "rickets is the result of a peculiar form of chronic dyspepsia, in which certain toxines are formed from bacterial action, and it is the passage of these toxines into the blood from the alimentary canal that gives rise to the pathological changes which take place in the disease."—(Dr. H. Ashby: "Encyl. Med.," art. *Rickets.*)

This confirms us in the importance we have previously placed on the inquiry into food and housing. Whatever the initial cause, rickets is essentially a disease of nutrition. It is frequently associated with scurvy.

The leading effects of rickets are these—square head, as the result of excessive formation of bone at the ossifying centres of frontal and parietal bones; delayed dentition; delayed union of skull bones; beaded ribs, the "rickety rosary"; narrow and constricted chest, pigeon-chest, which results from obstructed respiration when the chest walls are too yielding; curvature of leg bones, thigh bones, arm bones, spine; enlargement of epiphyses at wrists, ankles, knees; enfeebled muscle and deficient muscular development; relaxed ligaments; gross deformities—knock-knee, flat-foot, mis-shapen pelvis; delayed nervous and mental development. These signs mark the early

stages of the disease; they are to be found in the very young infant; but many of the effects are permanent and permanently lower the efficiency of the child. In the milder forms, the remaining effects are principally enlarged wrists and ankles, and beaded ribs; in the severer forms, gross deformities of limbs, spine, pelvis, chest, &c.

3. *Joints.*

Affections of the joints follow many, if not most, of the specific infections, such as typhoid fever, acute pneumonia, scarlet fever. Many of these affections are probably due to pus-producing organisms, which supervene on the specific disease. All these affections, however, are acute or are found in association with infectious disease. They are, therefore, not likely to be met in school children at school. It is not so with tuberculous diseases of the joints. These are to be met with in many varieties, which are classified by Dr. Alexis Thomson under the following clinical types:—Tuberculous hydrops, cold abscess, white swelling, tuberculous arthritis, caries sicca. The great joints—hip and knee—may be found affected. In particular, hip-joint disease (morbus coxae) should be watched for. The early stage is apt to pass unnoticed by the inexperienced eye. When any child rests habitually on one leg, or, when standing, rests one foot on the top of the other, the teacher should direct the medical inspector's attention to the fact. If there is perceptible limping or dragging so as to maintain the hip-joint rigid, the disease may be already well advanced. There may be pain in the hip. More frequently, the child complains of pain in the knee. But by the time the child complains of pain, he is not likely to be left at school. Consequently, even this relatively common joint disease will be relatively uncommon at school.

4. *Deformities.*

The following deformities may be met with in school children at school:—

(*a*) Congenital dislocation of hip.

(*b*) Deformities due to paralysis, *e.g.*, spinal curvature, under-grown and powerless limbs (infantile paralysis).

(*c*) Deformities due to rickets; noted under rickets.

(*d*) Supernumerary fingers, web-fingers, hypertrophy of fingers, and others—all congenital.

(*e*) Similar deformities of toes.

(*f*) Club-foot—congenital and acquired. Congenital club-foot is the most frequent. Acquired club-foot results from paralysis or injury.

(*g*) Flat-foot—frequently resulting from rickets. Flat-foot is practically always an acquired deformity, resulting from excessive strain on the arch of the foot when the child is enfeebled by illness, such as acute fevers, or rheumatism.

(*h*) Bow-legs; most commonly due to rickets.

(*i*) Knock-knee; also most commonly due to rickets.

(*j*) Hernia—umbilical, inguinal, femoral.

Most of these are gross and obvious deformities. But in the case of flat-foot and knock-knee, the variation may be so slight a departure from the normal as to escape notice, except on careful examination. The medical inspector, however, is concerned with deformities only in so far as they affect the school work of the child. Many of those enumerated are of minor importance, and from the immediately practical standpoint are mere curiosities. None the less it is important to observe and record them, for many of them are capable of rectification, and thus by early treatment they may be made less of a hindrance to future industrial efficiency.

5. *Illustrations.*

The frequency of the occurrence of deformities among school children at school may be roughly gauged from the results of the Edinburgh and Aberdeen investigations.

(*a*) *Glands.*

In Edinburgh.—" The large number of glands has been partly accounted for above. The number of true tuber-

cular glands was not great; but neck glands are always an indication of tissue susceptibility, and any gland may become tubercular. The incidence of glands varied with the schools. In South Bridge, 45 cases of enlarged glands were found; in London Street, 25; in North Canongate, 34; in Bruntsfield, 7. The small number of children found with affected glands at Bruntsfield was so striking that special attention was given to the examination, but the total number discovered did not exceed 7. This conforms to the facts recorded in the other tables, where the contrast between this school and the other schools, especially North Canongate, is sufficiently emphasised.

It is worthy of notice that the boys show a much larger number of glands than the girls. Boys show 66, as against girls, 45. Boys of nine to twelve show this preponderance most markedly. In North Canongate, there were 24 gland-affected boys as against 10 girls, and at Bruntsfield all the 7 cases were boys. In South Bridge and London Street, the distribution was approximately the same in boys and girls.

"From any point of view, the number of glands is very large." In each school 150 children were examined.

In Aberdeen.—"In males—Enlarged glands, 10 (including 3 discharging glands). In females—Enlarged glands, 2. The glands found to be diseased were all cervical. Every case of obvious enlargement was noted."

(*b*) *Bones—Joints.*

In Edinburgh.—"The amount of bone disease was trifling, and there was only one case of joint disease. The comparative absence of bone and joint disease is probably due in part to the fact that the hospital service of Edinburgh, being open to all classes, results in the elimination of bone and joint cases from the school population. In most cases the defects were due to rickets. In each of the three schools—South Bridge, North Canongate, and London Street—4 cases of rickets were found; in Bruntsfield, no case of bone or joint disease was found."

In Aberdeen.—"*Bones.*—In males—Rickets, 12; tubercular disease (tibia), 1. In females—Rickets, 5.

"Such of the cases of rickets as were associated with deformity are again included under 'Deformities.' They amounted to 7. In the cases of rickets, the following were the bones which more particularly indicated the existence of the disease:—Ribs, in 3 cases; tibia (curvature), 2; thigh bones (anterior curvature), 1; head, 1; head and chest, 4; general, 1.

"*Joints.*—In males, 0. In females—Rheumatism, 1."

(*c*) *Deformities.*

In Edinburgh.—"The small number of deformities found was at once surprising and gratifying. The patients were all boys. Eye deformities, *e.g.*, squint, are included in the Eye Table.

"There was one case of bifid, or split uvula, but the defect did not amount to cleft palate and was not recorded as a deformity. There was one case that showed a complete, or almost complete, double set of teeth both above and below. There was no case of club-foot, only two cases of flat-foot, not aggravated, and only four cases of slight knock-knee. There were a few cases of bow-legs due to rickets. No case of hernia was discovered, although a very stringent examination was made of 100 girls and 200 boys, and a general examination in the others. One or two cases of very slight exomphalos (umbilical protrusion), not amounting to hernia, were found in boys."

In Aberdeen.—"The deformities were few—only 21—and were, in most cases, not of a serious character. They are detailed in the accompanying table. It is possible, or even probable, that the method of selecting the children, with the power of refusal to the parents, prevented a proper proportion of the deformed children appearing among those examined; but in any case, as could be seen from a general survey of the children in the classroom or playground, the proportion of deformed children was small.

"No case of club-foot was found among the children examined, and only two cases of flat-foot. No child was marked as having the latter deformity unless it was such

as appeared to require medical attention. It may be remarked that the typical Aberdeen foot is, in the experience of the reporter, much flatter than the foot of southern populations.

"Among the deformities noted were three pigeon-shaped chests in males, and two in females.

"The kyphosis (hunchback) noted was in the same boy as suffered from bifurcated uvula."

CHAPTER XXI.

Leading Signs of the School Infections.

1. *Introductory.*

In the present chapter, we note only the signs that every class teacher should be able to recognise without difficulty. He may not in all cases be able to interpret the signs observed, but, with very little experience, he will be able to decide whether any given symptom is a departure from the normal. Fortunately, in Scotland at least, the organisation for dealing with infection makes the path of the teacher easy. He is, as a rule, forewarned of epidemics. He is informed of individual cases of infection. He has many opportunities of learning the existence of infection when no other officer has reason to suspect it. He is constantly in touch with the children, and, through them, with the localities they come from. In the rural districts this is especially the case. He has every inducement to exclude infection from his classes. He has every sanction for doing so. He is thus in every respect peculiarly well-placed for discovering infections at an early stage. In the following notes, therefore, we emphasise certain obvious and unmistakable signs.

2. *Fever in General.*

For our purposes, fever means a rise of the temperature of the body above normal. The normal temperature, taken in mouth or axilla, is 98·4° to 98·6° Fahrenheit (37° Centigrade). In children, the temperature readily varies. Slight variations, for example, half a degree above normal, may be of no practical importance and may occur without any marked symptom. Among the 600 Edinburgh school children was found one child with a temperature of 102° F.; yet there were no external symptoms to attract the attention. Dyspepsia, toothache,

"colds in the head," sore-throats, and any slight inflammatory condition may be the cause of slight fever, and the only symptom may be fretfulness or inattention or flushed cheeks. The signs of increased temperature are thus frequently of little value to any but the experienced eye. Where some disease accompanied by a noisy symptom, such as cough, is present, the teacher's attention is naturally and properly directed to it. But the teacher should also note any appearance of hot skin, shivering, headache, sickness, thirst, prostration, drowsiness, irritability. It is difficult to describe, but easy to detect, the difference between the rose-pink of health and the flush of fever. It is not intended that the teacher should be required to test the temperature of his pupils, but it will economise the work of medical inspection if he accustoms himself to note the signs named. Fever, in this connection, is not a disease, but a symptom. It may be due to some slight and evanescent ailment or it may be the sign of the onset of some specific infection. In all cases it is important. No child with a temperature from one to two degrees above normal ought to remain in school. The presence of fever means the disturbance of all the bodily functions, an increase in the rate of tissue changes, increase in the rate of waste.

In specific fevers, it is of the first practical consequence to detect the beginnings. Accordingly, on all grounds, the teacher should familiarise himself with the signs and symptoms of increased bodily temperature.

3. *Signs of Scarlet Fever or Scarlatina.*

In children, scarlet fever (also named scarlatina) frequently begins with severe shivering, or even convulsions. A very frequent and very early symptom is vomiting. The pulse rapidly rises as high as 140 to 160 beats per minute. The temperature may rise to 103° F., 104° F., 105° F. These conditions result in excitement, great heat and dryness of the skin, diffused flushing of the face. All these symptoms may appear on the first day. Further, the throat may become painful and the glands

in the neck may be swollen. In adults, throat symptoms are usually the first to attract attention. In children, the rapid pulse and hot skin are among the earliest symptoms.

Within twelve to twenty-four hours of the earliest symptoms, the characteristic scarlatinal rash appears. "It may be detected very early on the sides of the neck and over the chest as well as in the neighbourhood of large joints. It afterwards spreads to parts of the face, to the abdomen, and over the limbs" (Moore). The eruption proper does not appear on the face; the diffused blush of cheek and forehead may sometimes be mistaken for it. But it appears on the neck and the back of the hands.

Whenever the eruption accompanied by these symptoms appears, the child should be at once reported for medical examination.

So far the early stages of the disease. As a rule, the headmasters are forewarned of scarlet fever epidemics and the opportunities for diagnosis may become only too frequent. It is important to remember that the disease is infectious from the very outset, and remains infectious through its whole course.

The most troublesome stage, however, is the desquamative stage. Peeling of the skin begins in severe cases on the third or fourth day, often earlier; in mild cases, from the sixth to the ninth day. But frequently the peeling is delayed for several weeks. The skin may come off in the form of fine powder, and the process of peeling passes unnoticed. The first parts to peel are the neck and chest; the last are the hands and feet. When a child is found with peeling hands or feet, or with loose scales about the neck, he should be at once carefully examined. If there is a history of sore-throat, or sickness, however slight, he should be referred for medical examination. In times of scarlet fever epidemics, many cases pass undetected in the early stages. If he has been absent from school, he may return to complete his desquamation there. What is still more dangerous, he may return with a discharging nose, which may be mistaken for "cold in the head."

Such discharges are extremely virulent, and a single child may infect several others. When scarlet fever is prevalent in any region, no nasal discharge of any sort should be neglected. A further symptom of some importance should also be noted—the pallor that follows an acute attack of scarlet fever. This may be a symptom of kidney affection and may be accompanied by swollen face or feet. In undiagnosed cases, the first obvious signs of illness may be such pallor and swelling.

Scarlet fever symptoms do not appear until from twenty-four hours to seven days after the child has been exposed to the infection. As a rule, they appear on the second or third day after exposure.

4. *Signs of Measles.*

In measles, the symptoms preceding the eruption may last for four or five days. As in scarlet fever, the child may have a fit of shivering or even convulsions. He is easily fatigued. He complains of headache. He gives signs of pains in his joints. His skin is hot and dry. His pulse is rapid. His temperature rises rapidly to 102° or 104° Fahrenheit. Up to this point — the end of the first day—there is little to distinguish the disease from scarlet fever. About the second day, the characteristic catarrhal symptoms appear. The child sneezes. His eyelids grow red. His eyes are bloodshot and watery. He shuns the light. He has all the symptoms of a bad "cold in the head"—occasional stopping and occasional catarrh of the nose, hoarseness of the voice, cough, and sometimes bleeding at the nose. Then a bright red flush all over the skin may appear, and, so far as the eruption is concerned, measles at this stage is difficult to distinguish from scarlet fever. But the presence of the marked catarrhal symptoms of eye and nose is usually enough to enable the onlooker to decide in favour of measles. When these symptoms have lasted for about four days, the eruption proper appears. By this time, however, the child is likely to have been withdrawn from school. It is relatively uncommon for a child in the eruptive stage to be fit for school attendance.

The eruption of measles, unlike the eruption of scarlet fever, appears first on the face. The spots at first resemble flea-bites. They gradually form into crescentic groups. The true skin appears pale between the groups. Sometimes, however, the eruption practically covers the whole skin. The face by this time is considerably swollen. The eruption is, as a rule, at its maximum within thirty-six hours of its first appearance.

Measles is infectious from the very first appearance of the catarrhal symptoms, that is from the moment when the child shows symptoms of a "cold in the head." It is this fact that makes measles so troublesome at school. A child may be infectious for two or three days before the symptoms are regarded seriously. He may infect a whole class. This is one among many reasons why nasal catarrh, apparently so slight an ailment, should always be promptly investigated, especially in the infant departments.

Measles also results in some degree of desquamation or peeling, but at this stage it is not seriously, if at all, infectious.

The eruption of typhus fever may, in young children, be mistaken for measles. But typhus fever is now so rare that it may be practically disregarded.

Symptoms of measles do not appear until about twelve to fourteen days after the child has been exposed to infection.

5. *Signs of German Measles.*

German measles, otherwise named rubeola, rubella, epidemic rose-rash, rötheln, is a disease sometimes strongly resembling measles, at other times resembling scarlet fever. Frequently, it is so mild that no preliminary symptoms are noticed. In the more marked cases, however, the child is dull and languid, he shows signs of headache, chilliness, loss of appetite, general uneasiness, and there may be vomiting and diarrhœa. As in measles, the eruption first appears on the face and neck. As the name "rose-rash" indicates, the spots are rose-coloured and slightly raised above the skin. The eyes are congested, there is running at the nose, and there may be a certain

degree of sore-throat. These conditions, however, are not so marked as in measles, and they, as a rule, succeed the eruption; they do not precede it. German measles is sometimes called "measles without catarrh." But when the eruption is fully developed, it is sometimes difficult to distinguish the one disease from the other. In measles proper, however, the child is, usually, too ill to attend school after the eruption appears. In German measles, the illness is not so marked, if, indeed, any illness be noticeable at all. One sign of German measles is of great importance, namely, the enlargement and hardening of the lymph glands a little behind the ear and also of those immediately at the back of the head. The temperature, as a rule, does not rise above 101° F.

This disease is not itself very serious; but it may be the starting point of tubercular infection of the glands.

German measles is infectious.

It may be added that German measles is extremely various in its manifestations. It has given rise to immense difficulty in diagnosis, but its occasional mildness should never lead to its neglect.

Dr. Clement Dukes, who has made a very exhaustive study of the disease in England, says—"The disease appertains to spring and early summer; out of the 275 cases which I tabulated in 1896, all but four occurred between March and July. And it becomes epidemic every five or six years."—(Green's "Encyclopædia Medica," art. *Rubella.*) He also states—"The lymphatic glands throughout the body are enlarged, tender, and hard like peas—notably the posterior cervical, axillary, and the inguinal. But they never suppurate."

Symptoms of German measles do not appear until about twelve days after the child has been exposed to the infection.

6. *Signs of Chicken-pox, or Varicella.*

This disease is extremely common among school children. Almost all children at one time or another are affected by it. In many particulars, it resembles small-

pox. The eruption, which is preceded by the usual symptoms of fever, appears first as small red spots; in a short time, it may be a few hours, these become blisters, which are filled with clear liquid. Later, they turn yellow. Later still, that is in two or three days, they burst, dry up, and form dark scabs. The same child may show at the same time spots, blisters, and scabs—some on one part of the body, some on other parts. Occasionally, the blisters run together to form larger blisters and consequently larger scabs. Frequently, the disease is mild; but frequently, it is very severe, and the sores resulting from the blisters may persist for weeks or even months. The blisters first appear on the chest, next on the face and scalp, lastly on the limbs. "They increase in size up to the third and fourth day, when they are about as large as split peas" (Moore). If pricked with a pin, the liquid oozes out and the blisters collapse—differing in this respect from the vesicles of small-pox. These, on pricking, do not collapse.

The disease is infectious. Symptoms do not appear until about twelve days after the child has been exposed to infection. It remains infectious until all scabs are removed.

Occasionally, especially in the later stages, it is very difficult to distinguish chicken-pox from small-pox. It is all the more important that the teacher should instantly report any eruption of blisters observed in any child. The disease is not, as a rule, serious in healthy children. It is now regarded as an entirely different disease from small-pox; but in times of small-pox epidemics, the two diseases are frequently confused even by experienced practitioners.

7. *Signs of Small-pox.*

Among school children, small-pox is extremely rare. Even when it does occur, the fever symptoms preceding the rash are usually too severe to permit the child to attend school. In the milder cases, however, that is those occurring in vaccinated children, the preliminary illness

may be very slight. Occasionally, therefore, during small-pox epidemics, a small-pox eruption may be seen at school.

The eruption is first noticed on the head, neck, face, and wrists. It then spreads on the trunk. Finally, it appears on the lower limbs. The eruption resembles the eruption of chicken-pox; but the blisters are hard and shotty.

Small-pox is extremely infectious to those unprotected by vaccination or by a previous attack. When small-pox is known to be epidemic in any district, the teacher should scrutinise every day the faces and wrists of children coming from an infected district. When he discovers any pimples on forehead or wrists, he should forthwith report the case for medical examination. In Scotland, small-pox is almost unknown among school children; but when it does occur, it occurs in so mild a form that it is apt to elude the observation even of the skilled.

Symptoms of small-pox do not appear until twelve days after the child has been exposed to infection.

8. *Signs of Mumps.*

This disease is extremely common among school children. The first signs are pain, stiffness, and slight tenderness at the angle of the jaw below the ear. These conditions first appear on one side, commonly the left. They are soon followed by swelling. The opposite side begins to swell from twenty-four to thirty-six hours later. Both sides reach their maximum about the fourth day from the first appearance of pain. As a rule, there are symptoms of fever; but in mild cases, these often pass unnoticed.

The disease is extremely infectious. It may lead to serious complications. Dr. J. S. Fowler states—"Mumps is extremely contagious, and there is no doubt that the infection may be conveyed, without personal contact with a case, through the intermediary of a third person or by fomites (articles of clothing, dust, &c.). Epidemics are most common in cold and damp weather and in the spring and autumn, perhaps because the climatic conditions then

prevalent tend to prevent the due ventilation of dwelling-houses. Epidemics not infrequently follow outbreaks of measles. Boys are somewhat more liable to be infected than girls, and it is said that mouth-breathers are peculiarly liable to the disease. The incubation period is very variable; it may be as little as three days, but more commonly lies between fourteen and twenty-five days, the average being perhaps seventeen to twenty-one days. But medical officers to school associations recommend twenty-four days' quarantine, dating from the first exposure to infection."—("Encyclopædia Medica," art. *Mumps.*) The disease is infectious for three to four weeks from the beginning of symptoms.

Swellings resembling mumps are occasionally seen in bad cases of diphtheria or scarlet fever.

9. *Signs of Whooping-cough.*

This troublesome and very fatal disease begins with the symptoms of "cold," slight cough, nasal discharge, sneezing, watering of the eyes. There are also other symptoms of fever. These conditions may persist for one or two weeks and no other symptoms may supervene. But these mild cases, which frequently cannot be distinguished from ordinary bronchial catarrh, are as infectious as the more severe cases. In typical whooping-cough, however, the characteristic convulsive cough with "crowing back-draught" is painfully noticeable. When a fit of coughing supervenes, the child usually seizes hold of the nearest support, coughs violently with a rapid series of short expirations, and then draws in the breath with a long, crowing sound. The fit of coughing is followed by the expulsion of mucus or by vomiting. "During the cough the child's face becomes much congested, often livid, giving the appearance of impending suffocation. There may be bleeding from the mouth, nose, ears, or any of the mucous surfaces."—(Dr. J. Carmichael: "Encyclopædia Medica," art. *Whooping-cough.*) Immediately after the fit of coughing, the child may again become bright and cheerful as if nothing had happened.

These typical conditions, however, are rarely seen at school. But in times of epidemic, the earlier stages are not uncommonly observed.

Whooping-cough is not, as a rule, placed on the list of notifiable diseases; but it is one of the most fatal of infections, especially in young children, and it ought always to be regarded as extremely serious. It is often difficult to distinguish it from the ordinary seasonal colds; but its presence in a district soon becomes popularly known, and the teacher will rarely be without some hint of its possible presence in the school.

Symptoms of whooping-cough do not appear until from fourteen to twenty-one days after the child has been exposed to infection.

10. *Signs of Typhoid Fever.*

In typhoid fever (also named enteric fever) the only sign likely to attract the attention of the teacher is the severe headache. This may be accompanied by bleeding at the nose and symptoms of general fever. There may be nausea, vomiting, and diarrhœa.

Typhoid fever is relatively uncommon among infants under five years of age. It is more common in children of five to ten years of age. It is still more common among children of ten to fifteen years of age. It is most common among persons from fifteen to twenty years of age. It is mainly an autumnal fever; but isolated outbreaks may occur at any season.

The other signs of typhoid fever are matters for careful medical investigation. When typhoid fever is epidemic in a district, every case of headache accompanied by sickness should be instantly reported.

Symptoms of typhoid fever do not, as a rule, appear until about fourteen days after exposure to infection. Sometimes, they appear as early as the eighth day after exposure; sometimes as late as the twenty-first.

11. *Signs of Typhus Fever.*

As in typhoid fever, so in typhus fever, headache is likely to be a very prominent symptom. In children, this

disease is marked by great drowsiness. There is high fever. The face is overspread by a dusky, suffused flush. Signs of fatigue are very prominent. The disease, however, is so rare, except in special localities, that no further description of it is necessary. The teacher is certain to be forewarned of any typhus epidemic. When such an epidemic occurs, every case of headache accompanied by extreme langour and fatigue should be instantly reported and dealt with. When the hygienic surroundings are bad, the disease is probably the most infectious of all the infectious diseases. It is also one of the most fatal.

Symptoms of typhus fever do not, as a rule, appear until from twelve to fourteen days after the child has been exposed to infection. But cases have been known to occur seven days after exposure, or even earlier, and twenty-one days after exposure.

12. *Signs of Diphtheria.*

Diphtheria is one of the most troublesome and one of the most fatal of the infectious diseases. To the teacher, the signs most likely to appear are—First, nasal discharges; second, "sore-throat." Diphtheria may exist at school in all degrees of severity. It may show itself as a mild cold, or as a prostrating illness. At certain seasons, "sore-throats"—forms of tonsilitis—affect vast numbers of children both at school and at home. At school, as at home, a single child may infect several others by contact, or by the passage of infected articles—such as pencils, pens, books, handkerchiefs, &c. Where these non-diphtheritic "sore-throats" prevail, the children are exceptionally liable to acquire true diphtheria. Consequently, all cases of "sore-throat" and nasal discharge ought to be at once reported for medical examination. Occasionally, the glands at the angle of the jaw will be so enlarged as to attract the teacher's attention. When this is so, further inspection should not be delayed. Children with persistent nasal discharge from any cause whatever should be carefully examined and supervised. It should never be forgotten that a "sore-throat" may be the first

obvious symptom of infectious tonsilitis, or scarlet fever, or diphtheria.

Diphtheria is due to the presence of a micro-organism (the Klebs-Lœffler bacillus) on the tonsils or throat. A feature of the disease in severe cases is an irregularly-patched, greyish or greenish white membrane on the tonsils or palate.

13. *Epidemic "Sore-Throat," or Catarrhal Tonsilitis, or Follicular Tonsilitis.*

These are names for an inflammation of the tonsils due to bacterial infection. The tonsils are enlarged. They are rapidly covered with a whitish exudation, which superficially resembles the membrane of diphtheria, and sometimes itself contains the bacillus of diphtheria. Even when this exudation does not contain the bacillus of diphtheria, it is infectious. A single case of "sore-throat" may infect a whole school. As we have already said, this form of "sore-throat" prepares the way for diphtheria, and ought never to be neglected. As in diphtheria, so in tonsilitis, the glands at the angle of the jaw may be enlarged. There is usually also fever. All cases of "sore-throat" should be forthwith reported for medical examination.

14. *Other Infections.*

Of the other school infections, ophthalmia, already described under eye diseases, is probably the most troublesome. The signs of influenza, erysipelas, epidemic diarrhœa, and some others, it is unnecessary to particularise. These diseases are usually too severe at their onset to permit the child to attend school.

In all the infections described, attendance at school is compatible with the presence of the disease. From the earliest stages, the diseases are all more or less infectious. It is, therefore, of supreme importance that the teacher should familiarise himself with the general signs of the major infections—scarlet fever, measles, German measles, chicken-pox, small-pox, mumps, whooping-cough, diphtheria, typhoid fever, epidemic "sore-throat."

PART III.

SCHOOL ANTHROPOMETRY.

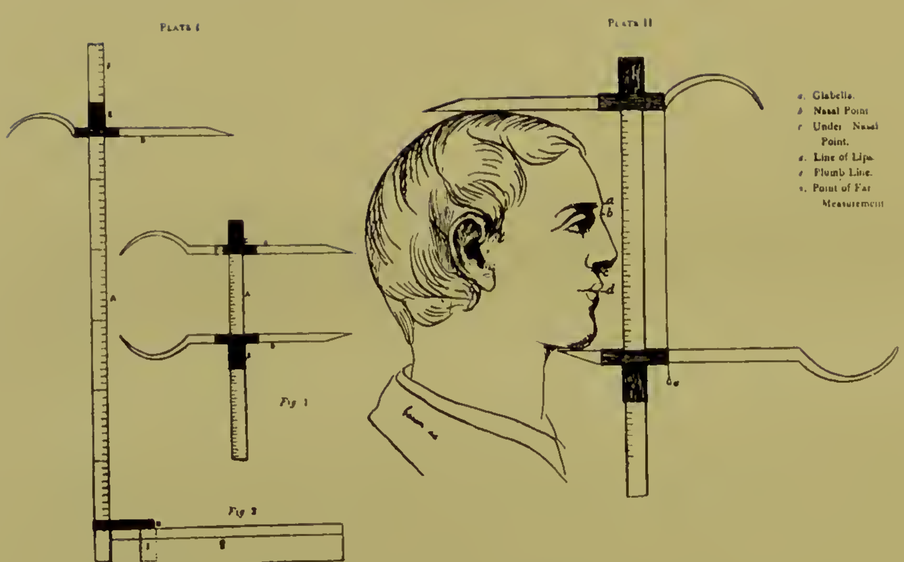

FIGURE 1.—DR. GARSON'S "TRAVELLER'S ANTHROPOMETER."

CHAPTER I.

Appliances for Measurement of Height, Weight, Head, Trunk, Energy, &c.

1. *Introductory.*

In this chapter, it is proposed to describe the instruments necessary for some of the leading anthropometrical measurements. As indicated at an earlier stage, these measurements must take a subordinate place in the economy of the school. Accordingly, only such methods of measurement are described as may readily be applied within school conditions, and the measurements selected are such as have a bearing on mental development and physical growth. An extended series of these measurements ought to afford to the anthropometrician some data for instructive correlations between mental capacity and physique, between muscular development and nervous development, between the growth of the skeleton and the growth of the great physiological systems, and so on. The descriptions are given as far as possible in the words of the designers of the appliances.

2. *Measurement of Height Standing.*

(*a*) *Dr. Garson's "Traveller's Anthropometer."**—As is obvious from fig. 1, "The Traveller's Anthropometer" can be adjusted for the taking of heights standing or sitting. Directions are supplied with the apparatus. It is unnecessary here to give them in detail. One precaution, however, should never be neglected either with

* "The Traveller's Anthropometer," manufactured by Aston & Mander, 25 Old Compton Street, London. See "Notes and Queries on Anthropology," p. 8.

this or with any other height-measure. The scale should be verified with a standard tape-line every time the instrument is fitted up afresh.

(*b*) *Avery's Measuring Standard.**—This is shown in fig. 2. It is a convenient form of measuring rod, which may be screwed on to a door or wall. It can be made in sizes suitable for measuring children of any height. The rod rotates, and the headpiece when not in use can thus be placed flat against the wall.

(*c*) *Professor Hay's Combination Apparatus for Standing and Sitting Height.*—This is fully described in chap. II. It was found of great service in the Edinburgh and Aberdeen investigations. Professor Hay has recently improved it. The mechanism for moving the headpiece works with great smoothness and makes it possible to take, in three or four seconds, accurate readings (to tenths of inches) of the height standing. The height sitting cannot be taken quite so rapidly.

(*d*) *Insurance Steel-yards.*—The common consulting room steel-yard usually has a measuring rod attached. It is sometimes an advantage to weigh and measure at the same time. The two processes may be accurately carried through in about half a minute or less. The headpieces fitted to weighing machine measuring rods are made to move smoothly. The height should always be taken before any weights are placed on the beam; the measuring rod should be adjusted on this supposition. Otherwise, the slight and varying depression to the weighing platform will result in error. This is, in fact, the chief objection to these attached measuring rods. If the rod is adjusted as above—that is, with the weighing beam at the highest point—all error may be avoided.

3. *Measurement of Height Sitting.*

"The subject," says Dr. Garson (*op. cit.*, p. 25), "should be seated low. Care should be taken to see that the body is held perfectly erect, the head in the same position as

* Manufactured by Messrs. W. & T. Avery, Limited, Birmingham.

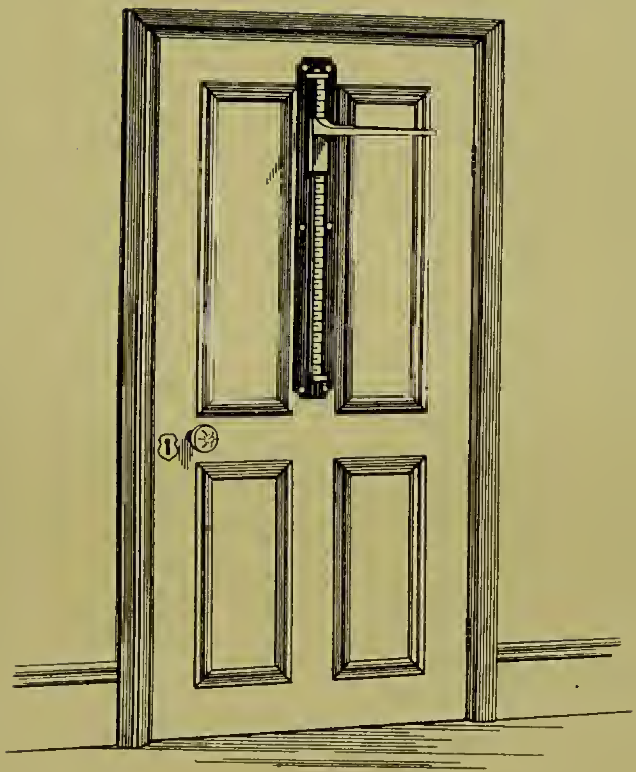

Figure 2.—Movable Height Measure.

when measuring its projections (see fig. 1, II.), and the legs should be close together, and at right angles to the thighs. The measurement is taken between the vertex and the plane of the tuberosities of the ischia, or bony prominences of the buttock on which the body rests when in a sitting position."

4. *Measurement of Weight.*

Among the multitude of weighing machines, it is difficult to select. The steel-yards used for insurance examinations are usually sensitive and accurate. It has to be remembered that all such machines are liable to very rough usage if left exposed in a school.

As to principle, the main choice lies between the steel-yard and the spring-balance. Each has its advantages and disadvantages. The steel-yard involves continual shifting and adjustment of small weights; but it can be graduated to an ounce. The spring-balance is more rapid, but the divisions on the scale are smaller and more liable to be misread. In both cases frequent testing is essential to accurate results. The steel-yard is clumsy; equally so are some patterns of spring-balance. Each medical inspector must use his discretion in the selection of machines; but one rule he should make absolute—Let the machine be tested before each series of weighings. The machines should be correct to a quarter of a pound. The weight should be taken without shoes, but with ordinary clothes.

5. *Measurements of the Head.*

The two chief measurements of the head are the maximum length from front to back, and the maximum transverse breadth. In order to estimate the volume of the brain, or rather the capacity of the skull, a third measurement is necessary—the perpendicular measurement from the vertex to the tragus or middle of the external opening of the ear.

(*A*) *Length of Head.*—The maximum length of the head is ascertained by measuring the distance between the glabella and the most prominent point of the occiput

or back of the head. The glabella is "the most prominent point in the middle of the brow between the eye-brows" (Garson). (See fig. 1.)

For this measurement several instruments have been designed. Of these, four are here described.

(*a*) *Garson's Callipers.*—These callipers, which are shown in fig. 1, consist essentially of a graduated stem with two arms, one of which may be fixed at zero. The callipers are adapted for several purposes. In order to measure the length of the head, the point of one of the curved arms is adjusted on the glabella and the point of the other on the most prominent part of the occiput. The distance is then read off.

(*b*) *Gray's Callipers.*—These callipers have been designed by Mr. J. Gray, B.Sc., with the special object of facilitating head-measurements. In the living subject Gray's callipers can be used accurately with very great ease. We quote from his own description, which is illustrated by fig. 3.

"In most countries on the continent of Europe the collection of statistics of the physical characteristics of the population is greatly facilitated by the conscription, and this, to a great extent, accounts for the fact that our neighbours are so far ahead of us in the ethnographical survey of the people. In this country we have to make use of less efficient means; since we cannot bring the people to us, we must go to the people.

"I have found it a very good plan to attend some assembly composed of natives of the district, such as a meeting for sports, or a fair. In order to get a satisfactory sample of the people of a district, it is necessary to measure at least from 100 to 200. The time available for doing this at such meetings is usually not more than three or four hours, and measurements have, therefore, to be very rapidly performed. The head-measurements should preferably all be performed by one person, and the only measurements possible, if one is to measure large numbers, are measurements of the length and breadth of the head. The callipers used must be such as to require the minimum time for adjustment.

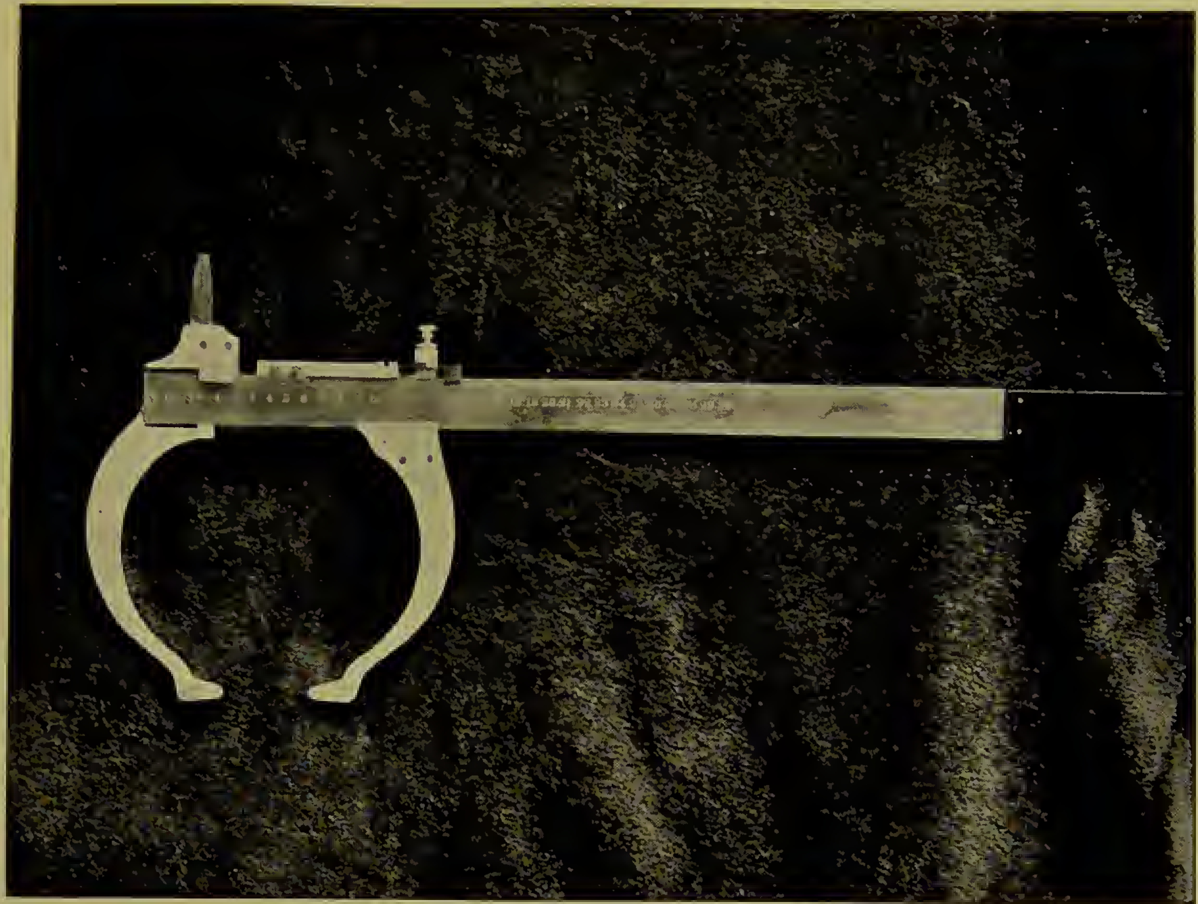

Figure 3.—Gray's Head Callipers, with Forehead Measure.

"*Callipers.*

"A callipers which I have designed for this purpose is constructed on the sliding principle. Callipers on this principle have the advantage over the compass callipers, that the readings from the scale are more accurate, because the scale is larger, and also lies parallel to the line to be measured. In the compass callipers, the scale lies nearer the pivot of the callipers than the measuring points, and divisions of the scale must necessarily be smaller than the standard size. Another objection to this kind of callipers is that the scale is an arc of a circle, while the line to be measured is a chord, and equal divisions on an arc cannot possibly be used to measure a chord.

"There is, however, a great objection to the sliding callipers as usually constructed. It will not, like the compass callipers, open automatically when pressed on the head, and this property is most essential for the rapid measurement necessary in field anthropology.

"My object was to design a sliding callipers that would open automatically, and thus combine the advantages of both types. A little mathematical calculation will show that this can be done if the slide to which the movable leg of the callipers is attached is made greater than a certain minimum length. This minimum possible length is still further reduced when friction rollers are used, as in the instrument shown.

"Instead of using a slide fitting everywhere closely to the beam of the callipers, only two pins with friction rollers are used. Since the strain coming on the leg of the callipers always tends to produce rotation in one direction, two pins at the extreme ends of the slide are all that is necessary to take the thrust. This reduces the cost of construction and prevents any jamming due to bad fitting.

"The friction of the bearings of the slide having been reduced to a minimum, it is necessary to introduce an artificial resistance to the movement of the slide, which can be regulated in amount. A callipers which is suited for measuring a skull or other rigid body is not necessarily

the best suited for measuring the living head, which, owing to the presence of the skin, is elastic, resembling, say, an indiarubber ball. To get uniform measurements of the diameter of an indiarubber ball with the same or different instruments, it is necessary that the points of the callipers should always press on the ball with some pressure. This I have endeavoured to secure by fitting on the slide a brake whose friction can be adjusted by a screw.

"To standardise the callipers it is placed on a standard bar; the index line on the slide is then set on the scale to the length of the standard bar by slackening the screws by which it is clamped to the slide. Then the pressure on the brake is adjusted till the force required to separate the points of the callipers is equal to the required amount, a spring-balance being used to measure the force.

* * * * * *

"To measure the length of the head, the fixed point of the callipers is placed on the glabella, and the other end of the beam is pressed down. The movable limb of the callipers will then be opened automatically by the pressure of the back of the head till the maximum length is reached, when the callipers is removed from the head and the reading taken."

From time to time the instrument should be tested by a standard scale. The greatest care should be taken that there is no mal-adjustment of the brakes. In practice, it will be found that the hands get rapidly sensitive to the movement of the instrument.

Mr. Gray has designed several patterns of these callipers, but the principal movement is the same in all.

As Professor Hay's Bow Cephalometer was not completed in time, Gray's was the instrument used in measuring the heads of the Edinburgh and Aberdeen children. In the case of Edinburgh the particular instrument used had accidentally during use acquired an error of about two millimetres. In the comparison of the cephalic indices of the Edinburgh and Aberdeen children,

it would be necessary to deduct from the lengths and breadths of the Edinburgh heads one to two millimetres. The error, however, does not make much difference in the ultimate result.

(*c*) *Professor Hay's Bow Cephalometer.*—For description see chap. II.

(*d*) *Dr. Hepburn's Callipers.*—These callipers (fig. 4) have been designed by Dr. Hepburn for the rapid and convenient measurement of skulls. It is adaptable to many varieties of skull measurement. In general principle, it resembles Dr. Garson's. A special link can be fitted for measuring the cranial height.*

(*B*) *Transverse Breadth of Head.*—For the measurement of the transverse breadth of the head any one of the above instruments may be used.

The point of maximum breadth of the skull varies considerably in different individuals. The measurement intended is the maximum transverse breadth above the level of the ears. This maximum is sometimes high, sometimes low. It is not always readily indicated through the hair. Consequently, it is necessary to search it out with the callipers. With Gray's or Hay's callipers, for example, it is very readily ascertained. The callipers held vertically with both hands is moved gently in various directions until the maximum breadth is found. In this measurement there is always a possible error. The line of maximum transverse diameter must be at right angles to the line of maximum length. Otherwise, the measurement will be inaccurate. In practice, the eye must judge whether the long axis of the callipers is properly adjusted. Theoretically, no doubt, it is possible to devise apparatus that shall secure this result mechanically; but probably the error is, in the ordinary use of the instrument, practically insignificant.

Further details are given in Professor Hay's description of apparatus (chap. II.).

* Dr. Hepburn's Improved Craniometer Callipers (patent), manufactured by Andrew H. Baird, 37 and 39 Lothian Street, Edinburgh.

6. *The Cephalic Index.*

The ratio between the maximum transverse breadth and the length of the head is so constant that it has been made the basis of a racial index—the Cephalic Index. This is defined as the ratio of the transverse breadth to the maximum length, all multiplied by 100. The formula is—

$$\frac{\text{Transverse Breadth} \times 100}{\text{Maximum Length}} = \text{Cephalic Index.}$$

Example:—

$$\frac{13{\cdot}8 \text{ cm.} \times 100}{17{\cdot}3} = 79{\cdot}8.$$

"This index," says Topinard, "varies in the human races from 71·40 in Greenlanders to 85·63 in Lapps, in the averages of the series; and from 62·62 in a New Caledonian to 92·77 in a Slav (Wend) in particular instances. The difference is greater if we include the distorted skulls. A scaphocephalus in the Laboratory of Anthropology has an index of 56·33, and a Peruvian skull of an Inca, one of 103. The extreme indices are found in the long or dolichocephalic* skulls of Retzius ("Ethnologische Schriften" (1864), and in his round or brachycephalic. Between the two a term was wanted to designate the medium skulls, and M. Broca has called them mesaticephali. But from the fact that in practice there exists a vast variety between the extremes of the groups, M. Broca gave the name of sub-dolichocephali to the skulls which were less long, and sub-brachycephali to those which were less round. Hence he makes five divisions as follows:—

Cephalic Indices.

Dolichocephali, - - - - -	75·00 and under.
Sub-dolichocephali, - - - -	75·01 to 77·77.
Mesati-cephali, - - - - -	77·78 to 80·00.
Sub-brachycephali, - - - -	80·01 to 83·33.
Brachycephali, - - - - -	83·34 and above.

"This nomenclature is universally adopted in the

* (Greek—dolichos—long; brachys—short; cephale—head.)

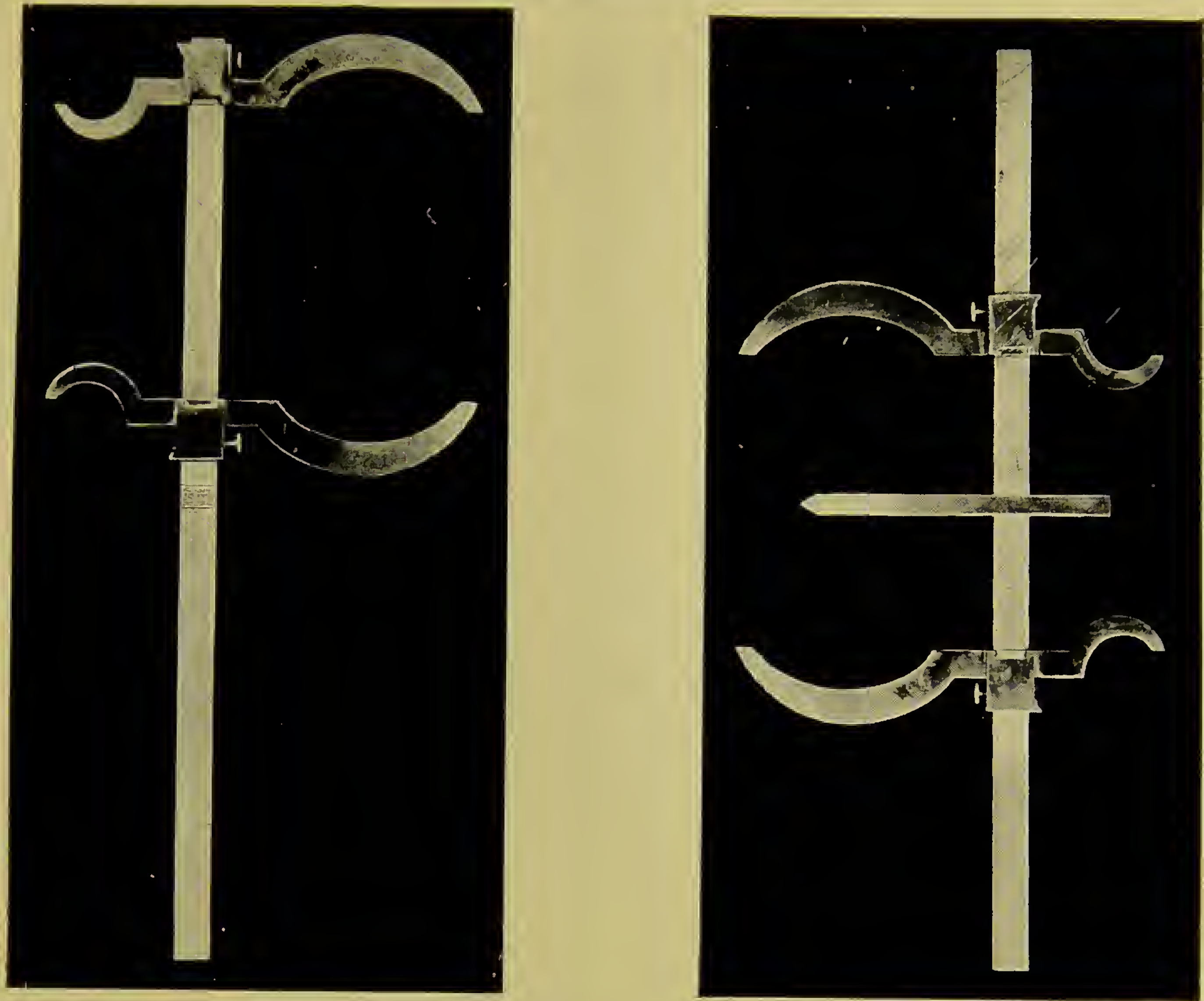

Figure 4.—Dr. Hepburn's Craniometer Callipers.

present day as being most generally useful, except by Thurmann, Huxley, and Welcker."—(Topinard: "Anthropology," pp. 237-8.)

The following is translated from Vierordt's "Daten und Tabellen," 2nd ed., p. 48:—

INTERNATIONAL NOTATION OF SKULL-INDICES.

Principal Groups.	Group.	Index.	
Dolichocephali	1	55·5—59·5	(Extreme Dolichocephalic).
Do.	2	60·0—64·9	Ultra-dolichocephalic.
Do.	3	65·0—69·9	Hyper-dolichocephalic.
Do.	4	70·0—74·9	Dolichocephalic.
Mesocephali	5	75·0—79·9	Mesocephalic or Mesaticephalic.
Brachycephali	6	80·0—84·9	Brachycephalic.
Do.	7	85·0—89·9	Hyper-brachycephalic.
Do.	8	90·0—94·9	Ultra-brachycephalic.
Do.	9	95·0—99·9	(Extreme brachycephalic).

"In the head, as compared with the skull, the cephalic index is to be reckoned as about 2—3 higher.

"The cephalic index for male skulls generally is about 80.

"For the contemporary Germans, on the whole brachycephalic, Weisbach finds an index of 81; for Czechs, 82·6; for the women, who are more brachycephalic, 83·1."

7. *Measurement of the Height of the Head.*

(*a*) *Garson's Method.*—The length from the vertex of the skull to the tragus of the ear may be measured with Garson's callipers. The method of taking this measurement is illustrated in fig. 1. The head must be poised horizontally, as when the height standing is being taken. The callipers are so adjusted that the long arm rests on the vertex of the head while the short arm is projected to the middle of the tragus of the right ear, at the point marked with a cross. The stem of the instrument must be held vertically. Dr. Garson insists on the importance of so holding it, and suggests that "a small plumb-line should be temporarily fixed to the base of the curved part of this upper arm or on the end of the carrier."

The vertex or highest point of the head, held as directed, is not always vertically in the same plane as the

tragus of the ear. Hence the necessity for the special adjustment of Dr. Garson's callipers. Sometimes the vertex is an inch or more behind the plane of the tragus; occasionally, it is almost in the same plane as the line joining the right and left tragus.

(*b*) *Dr. Hepburn's Callipers.*—These callipers may be used in the same way as Dr. Garson's. The point of one curved arm is placed on the vertex and the straight short arm is projected to the notch of the tragus. The other curved arm is first detached from the instrument, which is then practically the same as Dr. Garson's. (See fig. 1.)

(*c*) *Gray's Head-Height Meter.*—To use the head-height meter (fig. 5), insert the balls on the end of the side rods into the ear-holes. The height is measured in a vertical plane containing the line joining the ear-holes. It is not measured from the anatomical vertex, which needs some anatomical knowledge to locate precisely. "I have, however," writes Mr. Gray, "generally found that I could move the instrument a small distance on each side of the normal point without perceptibly altering the measurement. The instrument is very like Grattan's, described at the last meeting of the British Association (1903) by Professor Symington. The only novelty I can claim in it is the use of the screw, which ensures that the slide of the scale will not slip back, and the clipping button, or ratchet stop, which ensures that the same pressure is applied to the head when the measurement is taken. This principle of constant pressure, which I have also applied in the callipers, is, I think, of the greatest importance in measuring the living body on account of the yielding nature of the parts measured."—(Extract from special note explaining instrument.)

It is an objection to Gray's instrument, especially in measuring large groups of children among whom ear discharges are not uncommonly met with, that the balls at the ends of the ear-rods must enter the ear-holes.

(*d*) *Professor Hay's Vertex Cephalometer.*—This is described in chap. II.

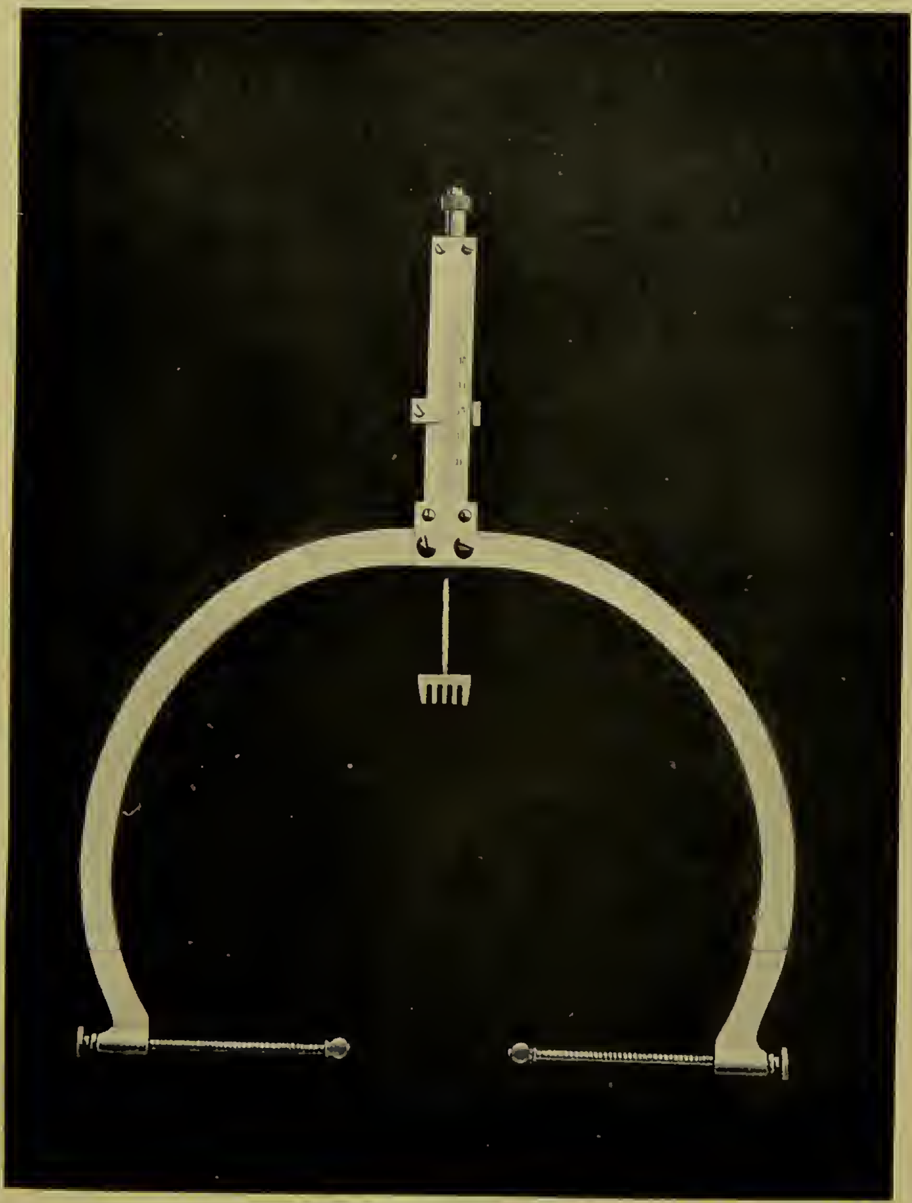

FIGURE 5.—GRAY'S HEAD-HEIGHT METER.

(For a comparison of results of Professor Hay's vertex cephalometer and Dr. Hepburn's callipers, see chap. III.)

8. *Cephalic Module of Schmidt.*

"By adding the length and breadth of the head and the height from the tragus to the vertex together, and dividing the product by three, the cephalic module of Schmidt is obtained, which enables us to compare approximately the volume of different heads."—("Notes and Queries on Anthropology," page 23.)

9. *Measurements of Trunk.*

In chap. II., Professor Hay describes an apparatus for trunk measurements. Further requisites are graduated tape-lines—one steel and one linen. The steel tape-line may be used for standardising. It is less liable to vary.

10. *Measurement of Energy—Dynamometry.*

The ordinary dynamometer may be used for older boys. But the instrument designed by Professor Hay is better adapted to children generally. (See chap. II.)

11. *Conclusion.*

The results of the Edinburgh and Aberdeen investigations are illustrated in chap. III. Some of the quantities will be of permanent value for purposes of comparison.

Note.—Mr. Gray's anthropometrical instruments are manufactured by Home & Rowland, Troughton Road, Old Charlton, London.

CHAPTER II.

Apparatus for Physical Measurements.

(Devised and described by Professor Matthew Hay.)

The following apparatus was devised for use in the investigation conducted by Professor Hay and Dr. Leslie Mackenzie for the Royal Commission on Physical Training.*

1. *For Measurement of Height.*

This apparatus differs from that in common use in supplying in one apparatus the means of measuring the height sitting (*i.e.*, from vertex to buttocks) as well as the height standing, and in being provided with a movable foot-rest to secure the horizontal position of the thighs during the former measurement, as also with a height gauge, or sliding arm, which admits of easy and exact adjustment and of accurate reading. Its construction is easily understood from the accompanying illustration (fig. 6). The foot-rest is not usually required for adults but is desirable for children. It is easily adjusted and also easily detached. The upright measuring rod is graduated on each side in both inch and metric scales, but the expense of the apparatus may be reduced by having the graduations confined to one scale. The rod is so placed in relation to the seat and the platform that the reading of the height is made from a point in the centre of a large opening in the sheath of the sliding gauge, which facilitates accuracy of reading. To obtain easy and exact adjustment the gauge is fitted with roller bear-

* The apparatus may be obtained from Messrs. A. & J. Smith, 23-25 St. Nicholas Street, Aberdeen.

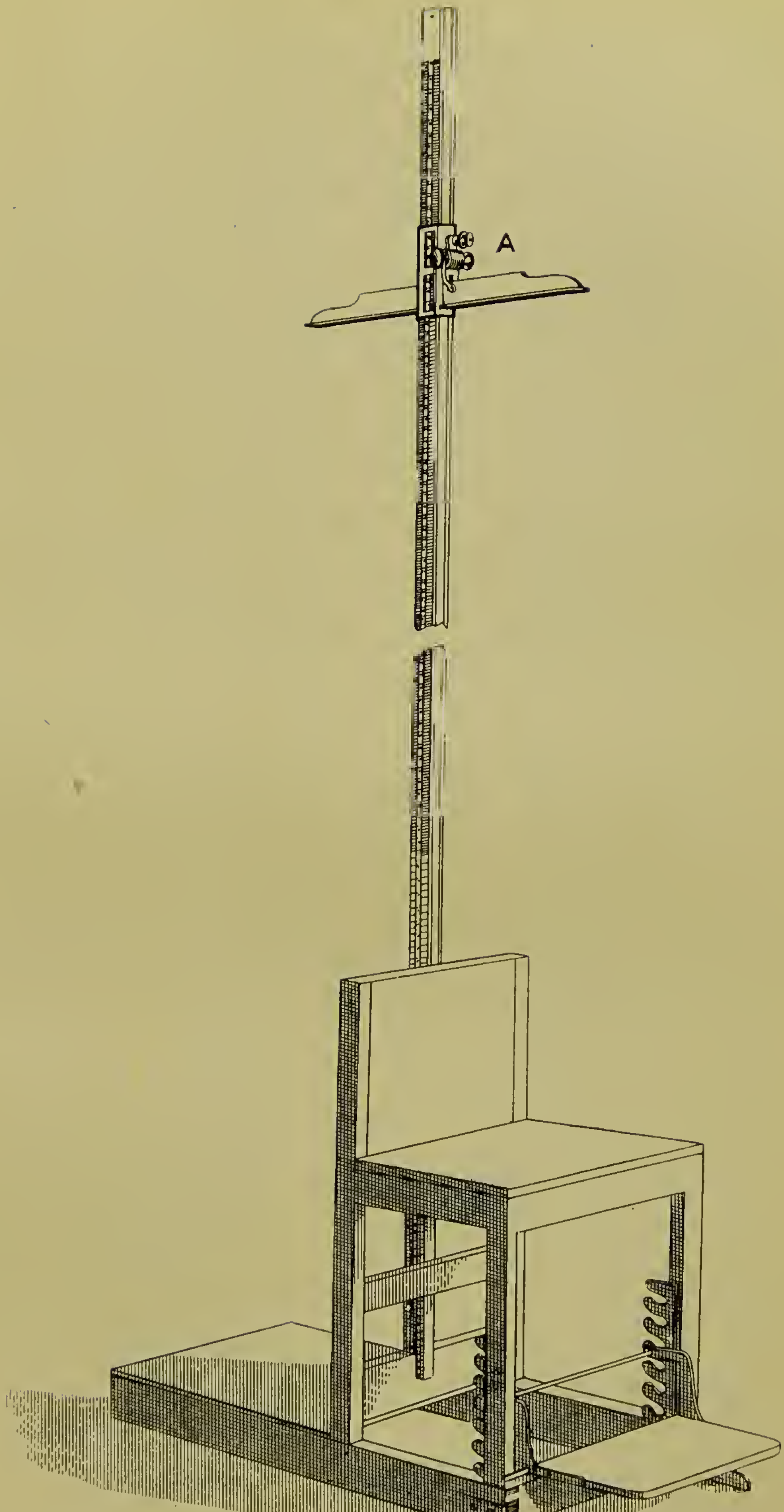

FIGURE 6.—HEIGHT MEASURER.

ings. One of these rollers shown at (A) in the drawing is about an inch in diameter, and has a corrugated surface, and is extended at each end into a large milled head, by turning which with the fingers the arm of the gauge can be adjusted with precision. The pressure of this roller against the measuring rod is regulated by a screw. To ensure perfect rigidity, along with lightness, the whole of the sliding gauge is made of aluminium.

It is important in both the height and sitting measurements to see that the head is maintained at such a level as would be natural to it when the eyes are looking horizontally forward. In the height standing, the feet should be close together, and the heels against the bar at the back of the platform. In the height sitting, the thighs must be close together and horizontal, the buttocks must be close to the back of the chair, and the spine must be erect.

The boots should previously be removed in taking the height standing, but it will be found inconvenient to insist on the removal of the stockings.

2. *For Measurement of Trunk and Limbs.*

For measuring the width of the shoulders, the pelvis, the hips, and similar parts, the callipers—which for convenience may be called the "trunk callipers," shown in the illustration (fig. 7)—are useful. They consist of a stout boxwood rule, graduated to centimetres or inches, with two curved aluminium arms, one of which is fixed and the other slides on the rule. In use the callipers are held in the right hand with the arms of the instrument turned away from the observer, whose left hand is free to adjust the points of the callipers to the body. The points should, by means of the right thumb applied to the sheath of the movable arm, be pressed tightly against the parts to be measured. The reading must be made before relaxing the callipers and while they are still in contact with the body.

The parts to be measured should preferably be bared, but if, as will usually happen in ordinary school measure-

ments, this is impracticable, the callipers should be applied over the underclothing, and a deduction made in accordance with the number of included layers of clothing.

In measuring the width of the shoulders the points of the callipers must be pressed against the outer side of the shoulder (or acromial) tips, while the arms hang loosely. For the width of the pelvis the widest parts of the haunch bones (iliac crests) are taken; and for the width of the hips the callipers are applied over the most projecting part (large trochanter) of the upper end of the thigh bones, while the person is standing erect with the feet close together.

If it is desired to measure the antero-posterior diameter of the chest, callipers with slightly longer arms than those shown in the drawing will be necessary, at least for older children.

In addition to the callipers, an ordinary tape is required for measuring circumferences, as of the chest and limbs. A well-made linen tape, graduated metrically or in inches, and about a quarter of an inch wide, and without a case attached, will be found suitable. Steel tapes, though more accurate, are difficult to handle. The pressure of the tape, in taking a measurement, should not be greater than to ensure that the tape is everywhere in contact with the skin, except in head measurements, when the tape should be applied tightly. The tape must pass evenly round the part to be measured. The circumference of the chest is measured immediately above the level of the nipples, and the average of the measurements at full inspiration and full expiration is recorded, or both measurements may be separately noted. In measuring the maximum and minimum circumference of the fore-arm, the limb should be held horizontally, with the fingers partially flexed; and in the case of the leg the person should be standing.

3. *For Measurement of Head.*

For this purpose two instruments have been specially devised—one, which may be called the "Bow Cephalo-

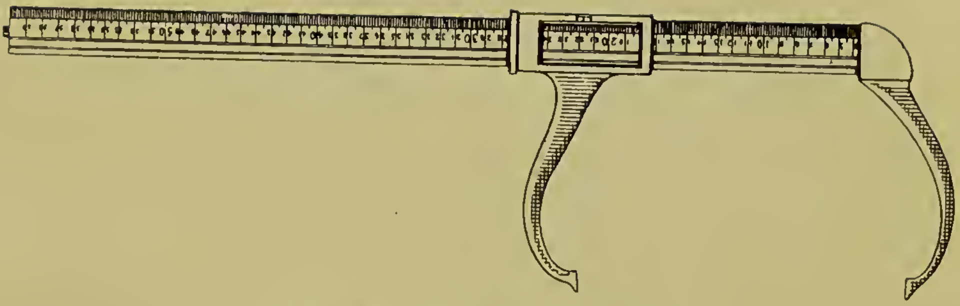

Figure 7.—Trunk Callipers.

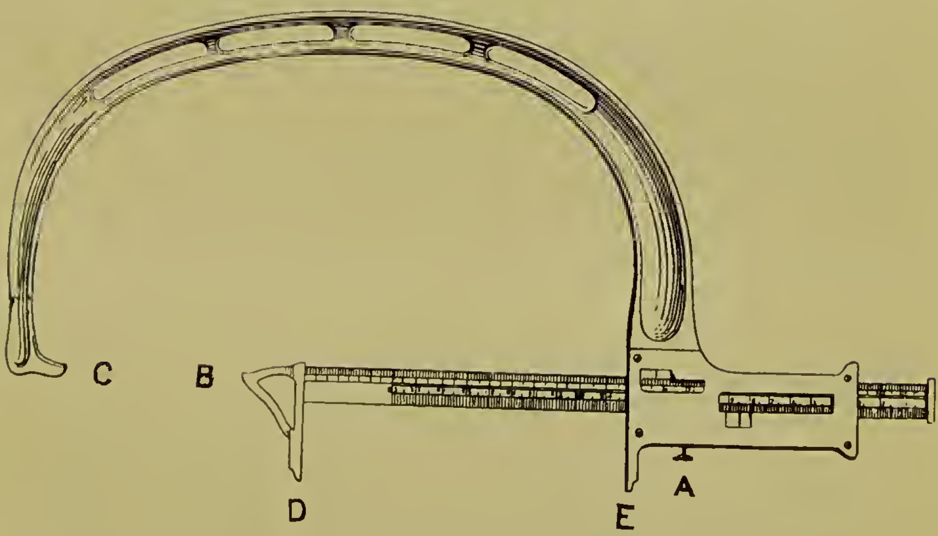

Figure 8.—Bow Cephalometer with Forehead Measure.

meter," for measuring the length and width of the head, and another, which may be called the "Vertex Cephalometer," for measuring the height of the head.

The Bow Cephalometer, following the principle of Gray's head callipers, is intended to measure the several diameters of the head with a self-adjusting and constant pressure of the callipers. It consists (see illustration fig. 8) of the rigid aluminium bow, large enough to permit easily of its including the head either length- or breadthwise. Through one extremity, which is also the handle, passes a graduated flat aluminium bar, which, in order to conduce to smooth movement, runs on roller bearings, but which has its freedom of movement regulated by an adjustable brake (A). The cephalometer is adapted for two sets of measurements—one between the inner end (B) of the graduated bar and the opposing extremity (C) of the bow, for ascertaining the length and greatest width of the head; and the other between the calliper points (D) and (E), for measuring the width of the forehead. The bar has, accordingly, two graduations, each with a separate indicator in the handle of the apparatus, as shown in the illustration.

In measuring the length of the head the observer should face the left side of the subject. Holding the cephalometer by the handle in the right hand, but with the little finger free to grasp and adjust roughly the graduated bar, he places the bow above the head, and with the left hand fixes and retains the extremity (C) over the glabella, or the centre of the bony ridge between the eyebrows (not the notch at the root of the nose). The end (B) of the graduated bar is, next, by means of the little finger of the right hand, pushed against the middle line of the back of the head about two inches or so above its most projecting part. The little finger is now removed from all contact with the graduated bar, and the handle of the cephalometer is pulled evenly and steadily down along the middle line of the back of the head until the end (B) of the graduated bar is quite clear of the head, when the instrument is removed, and the measurement read off. The degree of the resistance offered by the

graduated bar in the downward sweep should be previously so adjusted by the brake (A) that the bow by its own weight, when the instrument is suspended by the outer end of the graduated bar, will just be capable, or barely capable, of sliding down the bar.

The maximum width of the head is obtained by standing behind or in front of the subject, and holding the handle of the instrument in the right hand, as before, and the free extremity (C) of the bow between the fingers of the left hand, with the measuring points (B) and (C) on the same level. Starting with the points pressed against the head near the crown, and directly above the obviously widest part of the head, the observer presses the instrument down over the head until the points are free of the head, when the instrument is removed and the measurement read. It is essential to accuracy to maintain the equality of level of the contact or measuring points throughout their descent, and to see that the plane of the instrument is as nearly as possible at right angles to the mesial plane of the head.

The points of the instrument are so shaped as to facilitate their penetrating between the hairs and running in actual contact with the scalp. Where the hair is thick or long, as in females, care must be taken to see that the points are, as far as possible, in such contact.

The two measurements need not occupy more than a few seconds. Until confidence is acquired in the accurate use of the instrument, each measurement should be repeated.

The bow of the instrument is of sufficient strength and rigidity to be unaffected by all ordinary usage, but to prevent error in case of possible twisting from unusually rough treatment a 10 cm. rod is supplied for placing between the measuring points in order to test occasionally the accuracy of the instrument.

In measuring the minimum width of the forehead, or the narrowest part of the forehead, as measured from the lateral ridges rising from the outer extremity of the orbit, the calliper points (D) and (E) are used, the instrument being held horizontally with the

top of the bow next the body of the operator, and the handle and calliper point (E) between the fingers of the left hand, and the inner extremity and point (D) of the graduated bar in the fingers of the right hand. The bow should rest above the left wrist. In this measurement, being a minimum measurement, the self-adjusting pressure arrangement cannot be used, and the points of the callipers must be pressed by the fingers against the lateral ridges of the brow at the place where they are felt to give the minimum width, which is usually immediately above the eyebrows.

The Vertex Cephalometer, which was designed to obtain some notion of the vertical dimension of the part of the head containing the brain, is, like the bow cephalometer, made of aluminium. It consists of a horizontal flat bar, with two vertically dependent arms attached (see illustration fig. 9). The horizontal bar has a comb-like notching of its under edge to enable it to rest in immediate contact with the scalp. One of the dependent arms is fixed, and the other can be moved along the horizontal bar by a screw and nut arrangement similar to what is seen in some forms of cycle wrenches. Each arm is graduated and has a small sliding indicator with projecting pin attached.

In using the instrument the observer faces the subject, who stands with head erect. The instrument is held by the arms and placed transversely over the head, with the horizontal bar resting on the crown of the head, directly above the tragus or fleshy projection in front of the orifice of the ears. The movable arm is then adjusted so that both arms are close to the head, though not necessarily gripping it. As a rule, in measuring a series of children of about the same age, little or no adjustment of the movable arm is required for each child. Holding the curved lower end of each arm in each hand, the observer exercises a gentle downward pressure so as to ensure proper contact of the horizontal bar with the scalp, and at the same time, by means of the thumbs, moves the sliding indicators until the projecting pin of each touches, or is exactly opposite, the centre of the shallow notch in the front edge of the tragus. The

instrument is now removed and the indicated measurements from the top of the head to the tragus are read off from both arms, and the average of the two is recorded. There is almost always a difference between the measurements of the two arms, due sometimes to the upper bar not being held quite horizontally, but more frequently to a difference between the two sides of the head in respect of the position of the ear. Certain instruments in use hitherto have the defect of measuring one side only.

It is to be noted that this instrument measures from a point in the crown of the head vertically above the tragus, while some other instruments measure from the true vertex, or the highest point of the head. But the difference between the two is practically negligible, especially when regard is had to the difficulty in determining in the living person the true vertex, which varies with the attitude of the head. (Compare Mr. Gray's note, p. 386.)

4. *For Measuring Strength as indicated by Hand Grasp.*

For this purpose an instrument, which may be called the mercurial hand dynamometer, was constructed on the principle of the manometer. (See illustration fig. 10.) It consists of a piece of barometer tubing about $4\frac{1}{2}$ feet long, widened at the top to form a small cup (A), and bent upon itself at the bottom, where it is continued into a reservoir (B) about $2\frac{1}{2}$ inches long and half an inch in diameter. The upper end of the reservoir terminates in a narrow glass tube with two branches. To the upper branch is fitted a short piece of thick rubber tubing which is closed by a screw clamp (C), while the lower and horizontal branch is connected with a stout rubber ball (D) of a convenient size to be grasped by children. The whole tubing is fixed to a wooden stand, with a graduated scale. The reservoir is filled with mercury until it reaches zero on the scale, with the clamp at (C) open. The clamp is then tightly closed. The person whose strength is to be tested grasps the rubber ball in the hollow of the hand, with the thumb overlapping the

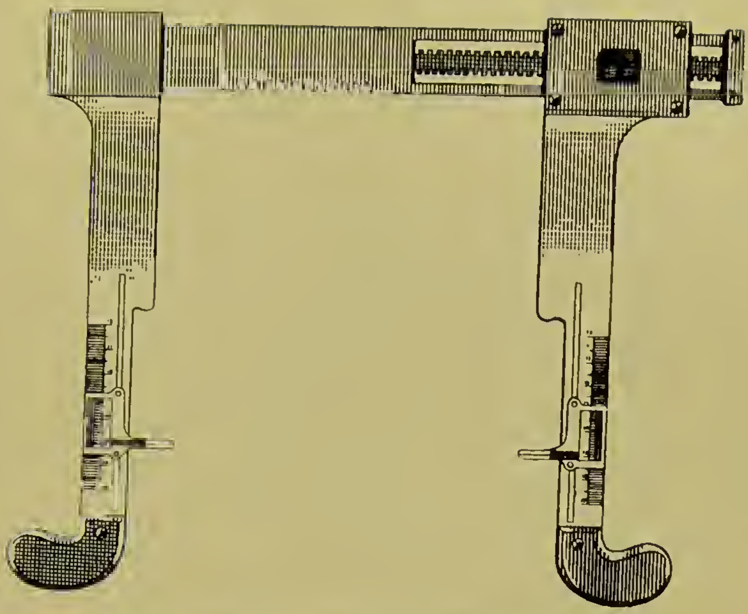

FIGURE 9.—VERTEX CEPHALOMETER.

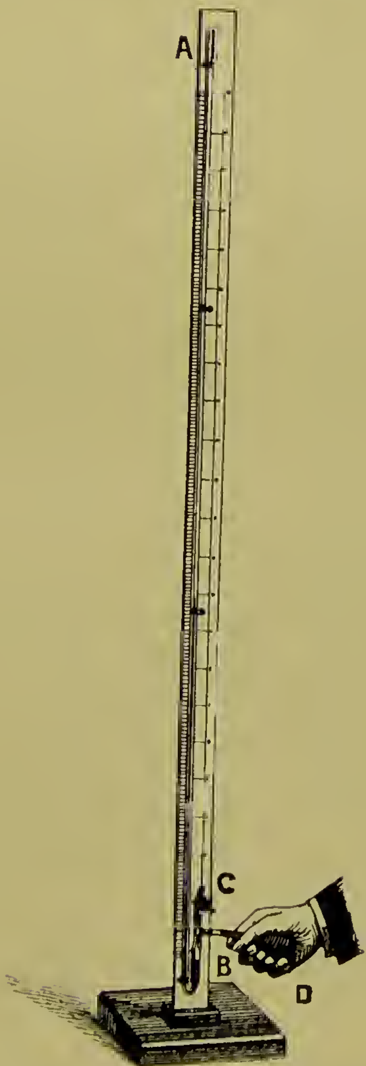

FIGURE 10.—MERCURIAL HAND DYNAMOMETER.

fingers, and by a steady, and not too sudden or jerky, pressure drives the mercury up the long upright arm of the apparatus. The height to which the mercury rises is the measure of the strength of the grasp, and the scale is so graduated as to enable this to be expressed in pounds of mercury per square inch; or it may be graduated in millimetres, if preferred.

The apparatus being designed for use in schools is, in order to prevent unnecessary height, not sufficient to measure the pressure of the hand of powerful adults, but it is sufficient for all young persons and for the majority of adults.

Two tests should be taken with each hand, and the higher of the two recorded. Subsequent tests often give lower results from the hand becoming fatigued. Care should be taken before each trial to see that the mercury stands at zero. If the mercury is not at zero, open the clamp at (C) for a moment, and again close it. If the rubber fittings are not quite tight there may have been a slight leakage of air in previous tests, but this will not take place if the instrument is properly constructed and the clamp is properly secured. The heat of the hand may also slightly expand the air inside the ball. It may also happen that a portion of the mercury has been accidentally lost. If this is so, it must be replaced.

It is important that the rubber tubing should be thick-walled. If thin, it will gradually distend and rupture under repeated use.

If air-bubbles break the mercurial column, they can be got rid of by inclining the apparatus somewhat and pressing the mercury, by means of the ball, into the small cup (A) at the top of the tube until all the air-bubbles are ejected, and then allowing the mercury to flow slowly back into the tube.

This instrument requires no skill in its use, and gives much more satisfactory results, especially with children, than the usual metal dynamometer or than the "bow-and-arrow" pull apparatus used by the Anthropometric Committee of the British Association.

CHAPTER III.

Illustrations of School Anthropometry.

1. *General.*

In Part II., we have given several illustrations of anthropometry in the school. The Report of the Royal Commission furnishes many more, varying from the simple measurement of muscle to the most elaborate measurements of head, trunk, limbs, &c. In what follows, we select a few instances from the Edinburgh and Aberdeen reports. These instances will indicate in some degree what is within the possible practice of every school. But anthropometricians have come to no final agreement on methods. Instruments differ in structure and in principle. The choice of measurements is governed by many, sometimes conflicting, considerations. The methods and measurements that best suit the science of races may not equally suit the science of education. We must still regard school anthropometry as essentially in the empirical stage. But this is only an additional reason why data should be accumulated. Their final evaluation must be the work of the skilled anthropometricians.

2. *Head Measurements.*

(*a*) *Cephalic Index.*—The following table shows the cephalic indices found as the result of measurements of the heads of the 600 Edinburgh children and the 600 Aberdeen children:—

Ages.	Edinburgh. M.	Edinburgh. F.	Aberdeen. M.	Aberdeen. F.
6–9	78·34	78·64	79·2	80·6
9–12	78·14	79·68	78·8	79·9
12–15	78·08	78·83	79·0	79·0

It is for anthropologists to determine whether the cephalic index in the growing has the same racial significance as in the grown. From the quantities given above, it is inferred that the greater variation of the Aberdeen figures means that the races are less fused. To check this inference, it would be necessary to study minutely the deviations from the average. Data for such study are to be found in the tables of the Edinburgh and Aberdeen reports.

On referring to the "International Notation of Skull-Indices" (p. 385), we find that both the Edinburgh and Aberdeen heads fall within the class mesati-cephalic.

Of the Aberdeen children, Professor Hay remarks—"*Head.*—The head was greater in all its dimensions among boys and girls, and the differences continued practically unaltered at all the ages examined. The difference ranged from 1·6 per cent. in the average maximum width to 2·8 per cent. in the average maximum length. The heads of the boys were, therefore, slightly more dolichocephalic or 'long-headed' than those of the girls; and the cephalic index was slightly less in boys (about 79) than in girls (about 80). The cephalic index was less in the older than the younger girls. In boys it was practically the same in all the age-groups. The type of the head, as determined by the cephalic index, was what is known as mesati-cephalic, and is very slightly broader than the average English head. The dimensions of the head increased less with the age than any other measurements taken, the increases during nine years varying from about 10 per cent. for the width of the forehead to 4 to 6 per cent. for the other dimensions. During the same period, the height of the person increased by 36 per cent. The width of the forehead as contrasted with the bi-parietal width, or width of back portion of head, was proportionally greater in the older than the younger children."

(*b*) *Height of Head.*—It is interesting to compare the different methods of measuring the height of the head.

The object of taking the height—the third dimension—of the head is to furnish data for an estimate of the volume of the skull. Where the shape is so irregular, it is obvious that an estimate of volume can be an approximation only; but the "module of Schmidt," though not necessarily indicating the precise volume, may yet be a constant of great value for comparative purposes.

The following extract from the Edinburgh report shows that there may be some variation in results where the instruments used are different:—

"For the measurement of the skull from vertex to tragus, circumstances made it necessary to begin measuring with the callipers devised by Dr. Hepburn, of the Edinburgh University Anatomical Department. The callipers is known as the Hepburn-Waterston callipers, and my thanks are due to Dr. Hepburn for its use. In using this instrument, Dr. Edwin Matthew and myself followed the directions in Garson and Read's *Notes*, &c., page 23, applying the callipers in every case to the left side of the head. A few of the measurements were made by Dr. Edwin Matthew; the great mass by myself. At the same time, I measured the heads with the 'double-vertical' instrument devised by Professor Hay. The difference in principle between the two instruments is this—with Professor Hay's, the measurement is made in the vertical plane of the tragus; with Dr. Hepburn's instrument, the measurement is made from the tragus to the highest point of the skull when the head is set for taking the measurement of height standing or sitting (see Garson and Read's *Notes*, &c., page 23). There is usually no difficulty in determining the highest point, which as a rule coincides with the anatomical 'vertex,' and lies very frequently about half an inch to an inch and a half behind the plane of the tragus. The measurement was made only from one side. The average of the measurements with Professor Hay's instrument was taken, and I have placed the results of both instruments in columns side by side in Table IV. It has to be added that in South Bridge School only a few measurements were made with Hepburn's callipers, and they

were not tabulated. Further, the last 50 children were not examined with the callipers. But in all, some 400 children were measured with both instruments. There is practically always a slight difference, the callipers giving the greater height. Except in a few cases, the same personal equation entered into both measurements.

"In order that the instruments may be strictly compared, I give below the average of measurements recorded for the left side of the head with each instrument:—

Age.	Hay.		Hepburn.		Difference.	
	M.	F.	M.	F.	M.	F.
6—9	12·21	11·73	12·42	11·89	0·21	0·16
9—12	12·38	12·02	12·56	12·15	0·18	0·13
12—15	12·60	12·24	12·65	12·28	0·05	0·04"

Dr. Hepburn's callipers were not used with the plumb-line, as suggested by Dr. Garson. Probably, therefore, the measurements recorded above may not show the same degree of accuracy as Dr. Garson's. But, on the average, the measurement with Dr. Hepburn's callipers was uniformly greater than the measurement with Professor Hay's instrument. This we should naturally expect; but whether the measurement by Garson's method is a nearer approximation than the measurement by Gray's or Hay's is a problem for experimental test. For comparative purposes, it seems indifferent which method is used provided the data to be compared have all been obtained by one method.

It may be added that another recognised method of measuring head-height is this—To the headpiece of the ordinary measuring rod for taking height measurements, an arm is attached by a hinge. The lower edge of this arm coincides with the lower edge of the headpiece. The arm can be moved laterally in the horizontal plane. To the outer end a vertical scale is attached. When the head is placed for height standing, it is obvious that the lower edge of the laterally-movable arm will be precisely at the same level as the headpiece, that is, at the level of the cranial vertex. The arm can be so moved laterally that the vertical scale stands at the side of the face. Thus the level of the tragus can be at once read off, and

the figure will show the distance between the vertex and the tragus. This method agrees in principle with Dr. Garson's, and is very simple in practice. It is used by Professor Reid in the Anthropological Department of Aberdeen University. There is no reason why this very simple and inexpensive mechanism should not be arranged for taking the vertical height of both sides of the head.

3. *Measurements of Neck and Chest, &c.*

In the Aberdeen report, Professor Hay has analysed in considerable detail the measurements of neck, chest, shoulders, pelvic crests, hips, limbs, wrist, calf, ankle. He indicates the variations between boys and girls. His analysis indicates clearly that from these measurements important practical deductions may be drawn. For detailed quantities, we must refer to the tables of the Edinburgh and Aberdeen reports. Meanwhile, we quote Professor Hay's analytical paragraphs—

"*Neck.*—The neck was thicker in boys than in girls at all ages, and by about 4·6 per cent. on an average, though, owing to the more rapid growth of the neck of girls, especially in the last two years, the difference was less at the later than the earlier stages.

"*Trunk.*—Over all the ages, the *circumference of the chest* was, on an average, 4·4 per cent. greater in boys than in girls, but the difference was less at the later ages, due, no doubt, largely, if not entirely, to the commencing development of the breasts in girls. In both sexes the rate of growth of the chest was greater in the later than in the earlier years.

"The chests generally were somewhat flat, and appeared capable of fuller development with a larger amount of properly-arranged exercise.

"Compared with measurements given for 'all classes' in the British Association Reports, the chest measurements of the Aberdeen boys were under the average by one to two inches at ten years of age, but the difference rapidly falls with each year of age until at fourteen to fifteen it is only about half an inch. No chest measure-

ments are given in the Association Reports for children under ten years.

"The *width of the shoulders*, as measured from the acromial tips, was greater, on an average, by 1·7 per cent. in boys than girls, but in the last two years (thirteen to fourteen and fourteen to fifteen) the difference became extinguished, and the girls showed the wider shoulders. The growth was fairly steady throughout the years, though somewhat more rapid in the later years, especially in girls.

"The *width of the pelvic crests*, or haunch bones, was greater in boys than girls until the last two years, when it became greater in girls. Within the ages dealt with, the width of the shoulders in boys grew more rapidly than the width of the pelvic crests, while among girls the reverse was true.

"The *width of the hips*, as measured from the outside of the large trochanters of the thigh bones, naturally follows in its growth the width of the pelvis, but the increase was more rapid in both sexes. As in the width of the pelvis, it was greater in boys than girls until the last two years, when it was greater in girls.

"*Limbs*.—The *girth of the forearm* was, on an average, about ½ cm. or ¼ inch greater in boys than girls. At eleven to twelve and twelve to thirteen in boys the girth rapidly increased, and afterwards increased more slowly. In girls it grew slowly at eleven to twelve, but increased rapidly afterwards.

"The *circumference of the wrist* was at most ages only slightly greater in boys than girls; at two ages it was the same or less; and at fourteen to fifteen the excess in boys was only 0·1 cm. or $\frac{1}{20}$ inch. If the average girth of wrist at each three-year age-group be deducted from the girth of the forearm, the following figures are got:—

Age-group.	6 to 9 yrs. cm.	9 to 12 yrs. cm.	12 to 15 yrs. cm.
Boys, - - - -	4·9	5·8	6·5
Girls, - - - -	4·6	5·3	6·1

From which it will be seen that the difference, representing the soft parts of the forearm, shows a fairly steady

increase with age in each sex, and that it is, at each age-period, greater in boys than girls by 0·3 to 0·5 cm.

"The *circumference of the calf* was greater in boys than in girls at all ages, except six to seven, twelve to thirteen, and thirteen to fourteen. The rate of growth of the calf is somewhat greater proportionally, in both sexes, than that of the forearm, being, from six to fifteen years, in boys, 38 per cent. for the calf, and 31 per cent. for the forearm; and, in girls, 35 per cent. and 33 per cent. respectively. This may point to insufficient exercise of the arms as compared with the legs.

"The British Association Reports give the average calf measurements of the Marlborough School boys, from the age of ten upwards. Compared with these, the measurements of the Aberdeen boys are less, by about three-quarters of an inch, at all the ages above ten, except at fourteen to fifteen, where the difference is reduced to one-third of an inch. The boys of that school belong to the better classes, and freely indulge, in common with the boys in all English public schools, in outdoor games.

"The *circumference of the ankle* was thicker in boys than girls at the earlier stages, but the difference gradually diminished, until, at the later stages, it was practically the same in both. If the girth of the ankle is deducted from that of the calf, the following figures are obtained:—

Age-group.	6 to 9 yrs. cm.	9 to 12 yrs. cm.	12 to 15 yrs. cm.
Boys, - - - -	7·6	8·4	9·7
Girls, - - - -	7·6	8·4	10·0

which, differing from the corresponding figures for the forearm and wrist, give (1) an equal or greater volume of soft parts in girls than boys at all ages, and (2) a much more rapid growth, in both sexes, at the later than the earlier ages.

"A comparison of the figures, in the text, for the forearm and calf shows that the increase of the soft parts of the forearm, between the lowest and the middle age-groups, was about 17 per cent., and between the middle and the highest groups, 13 per cent. The corresponding

percentages of the calf were 11 and 17. It may legitimately be asked if the greatly diminished rate of growth of the forearm at later ages, as contrasted with the greatly increased rate of growth of the calf at later ages, is not, in some measure, dependent on an inadequate amount of arm exercise."

As an illustration of the differences between the children of different schools in the same city, the following figures from the Edinburgh report are instructive. The schools in order of number were—(1) South Bridge; (2) London Street; (3) North Canongate; (4) Bruntsfield. The figures for height and weight in these four schools have already been detailed. The chest measurements show much the same relative differences. The quantities are all recorded in centimetres.

		(1)	(2)	(3)	(4)	Average.
6 to 9,	-	56·16	57·14	55·49	58·96	56·94
9 to 12,	-	64·15	61·97	60·61	62·26	62·25
12 to 15,	-	68·18	67·16	63·72	67·47	66·63

		(1)	(2)	(3)	(4)	Average.
6 to 9,	-	54·91	56·34	54·53	57·62	55·85
9 to 12,	-	60·15	62·17	59·76	61·94	61·01
12 to 15,	-	65·81	65·77	64·25	69·63	66·37

Here again North Canongate at all ages, males and females, is lowest. South Bridge is highest for males of nine to twelve and twelve to fifteen.

Among males of nine to twelve London Street stands low. The same is true for weight and height. (See tables.)

Bruntsfield is always above the average, but the preponderance is not so striking in chest measurements as in weight and height.

All the infants of six to nine, and the females of twelve to fifteen, are strikingly best in Bruntsfield.

4. *Measurements of Muscular Energy by Hay's Mercurial Hand Dynamometer.*

This dynamometer, which has been fully described by Professor Hay in chap. II., was found to respond with the greatest delicacy and precision. Both in Edin-

burgh and Aberdeen, it was put to a very severe test; but in spite of its apparent delicacy, it gave practically no trouble in management, and fitted equally well the most feeble and the most robust children. The movements of the mercury in the tube are very easily observed. This dynamometer seems likely to take a permanent place among school apparatus. Apart from its value as a delicate and precise dynamometer, it lends itself to the illustration of problems in air pressure and weight. It was devised by Professor Hay many years ago. Its adoption for the Edinburgh and Aberdeen investigations was an experiment amply justified by its ready adaptability to rapid, yet accurate, work.

The following extracts from the Edinburgh and Aberdeen reports will sufficiently show the results obtained:—

(*a*) *From Edinburgh Report.*—The numbers at the tops of the columns refer to the same schools as those named above.

		(1)	(2)	(3)	(4)	Average.
6 to 9, -	R.	6·52	6·66	5·22	6·79	6.30
	L.	6·38	6·67	4·88	7·17	6·28
9 to 12, -	R.	9·65	9·37	9·69	10·57	9·83
	L.	9·33	10·03	9·25	10·41	9·76
12 to 15, -	R.	12·64	12·17	11·05	11·4	11·82
	L.	12·12	11·82	10·76	11·18	11·47

		(1)	(2)	(3)	(4)	Average.
6 to 9, -	R.	5·77	5·10	4·99	6·30	5·54
	L.	6·40	5·45	5·01	6·51	5·84
9 to 12, -	R.	8·77	8·25	9·29	8·91	8·81
	L.	9·46	8·11	8·98	9·04	8·90
12 to 15, -	R.	10·95	10·69	11·23	11'66	11·13
	L.	10·67	10·69	10·42	10·82	10·65

"In the muscular and nervous energy, as indicated by the mercury dynamometer, North Canongate, though as a rule low, is not very conspicuously lower than the other schools. The male children of six to nine are feebler; but those of nine to twelve are, with the right hand, better than the corresponding boys of South Bridge and London Street. In Bruntsfield, whose boys up to the nine to twelve ages lead, there is a distinct falling off in grasp at the ages twelve to fifteen.

"Among females the North Canongate children of six to nine are the feeblest, but those from nine to twelve

are strongest, and those from twelve to fifteen are almost equal to the best. In South Bridge and London Street there is a slight falling off at the ages of twelve to fifteen.

"The dynamometer test is a fairly reliable test of musculo-nervous energy. Strong will plays an important part.

"Where any doubt arose, the test was repeated. Where the muscle was feeble the second effort usually resulted in a lower reading than the first. Where the muscle was good the second reading frequently was higher than the first."

(*b*) *From Aberdeen Report.*—"The muscular power, as tested by the *grasping power of the hand*, was found to be practically the same for each hand in both sexes. It was greater in boys than girls at all ages, but the difference diminished with increase of age. Thus, at six to nine years, the grasping power was 20 per cent. greater in boys than girls; at nine to twelve years, it was 16 per cent. greater; and, at twelve to fifteen years, it was 14 per cent. This is almost contrary to expectation.

"It is interesting to note that although the volume of the soft parts of the forearm was about 7 to 9 per cent. greater in boys than girls at each age-group, the difference in muscular power was greater than the difference in volume, indicating either that the volume of the forearm in girls contained less muscle and more fat than in boys, or that the muscle was less vigorous.

"In keeping with the diminished rate of growth of the forearm at later ages, already remarked, the hand grasp was found to exhibit in both sexes less increase between the second and third age-groups than between the first and second.

"It may be stated that the muscular power test used by the Committee of the British Association, which consisted in ascertaining the 'drawing strength' by one arm or hand pulling against the other, as in the use of a bow and arrow, a spring-balance marking pounds being stretched between the hands and being used as the measure, gave a much wider difference between boys and

girls than was obtained in the present inquiry. In the Committee's tests, the strength of the boys was at each age almost double that of the girls, though, as in Aberdeen, the difference tended to become less with advance of age. Such an enormous difference, which cannot be said to correspond fairly with the general difference in strength between boys and girls, makes it more than doubtful whether the test used by the Anthropometric Committee is a satisfactory one."

5. *Table of Deviations.*

There are many statistical methods of classifying and testing these measurements. It has been held that where, as in the Edinburgh and Aberdeen investigations, representative samples of children were selected, the method of simple averages tends to give misleading results or to obscure the significance of the quantities. Where numbers are so small, individual variations make a greater proportional difference in the averages. This is admitted. But as Professor Ogston has pointed out, the values claimed for these investigations do not depend on simple averages of height and weight; they depended equally on the comprehensive record of diseases and peculiarities in each individual case. As affording some check on the value of simple averages, Professor Hay suggested a table of deviations. Both for Edinburgh children and for Aberdeen children, a table was constructed to show the numbers that varied more than 5 per cent. above the average, and the numbers that varied more than 5 per cent. below. The quantities in these tables proved to be of value. They corresponded in a striking way with the masses of facts otherwise ascertained. It is impossible here to analyse fully the results obtained; but the following paragraphs will show that this method of stating the results may profitably be extended:—

(*a*) *From Edinburgh Report.*—"These tables of deviations exhibit the deviations exceeding 5 per cent. from the average weight, height, and some other measurements.

"In Table VA. I have shown these deviations for each of the four schools. The figures bring out with great emphasis the differences between certain schools. Thus, to take an example, in the weight columns it is found that, while North Canongate shows that among males of ages six to nine, seven were above the average by a deviation of more than 5 per cent. and fifteen below, Bruntsfield shows thirteen above and only two below. Similarly with females—North Canongate shows only three above and nineteen below, while Bruntsfield shows thirteen above and only five below. It is thus clear that the average weights of North Canongate were composed of a few good and a considerable number of bad, while at Bruntsfield they were composed of a few bad and a considerable number of good. The same is more or less true of the weights at the other ages. If the table is studied in detail, it will reveal with greater accuracy the relative conditions of the four schools in respect of weight, height, and the other measurements. For example, at South Bridge and London Street the number above and below were approximately equal, the number below being slightly in excess; at Bruntsfield the number *above* was considerably in excess; at North Canongate the number *below* was considerably in excess. So with heights, and circumference of chest, and less strikingly with grasping power."

(*b*) *From Aberdeen Report.*—"Remarks on the Table of Deviations.—The number of children at each year of age, with measurements outside the 5 per cent. variations from the average for the particular age, affords an index of the degree of variability of the different measurements. The parts of the body most liable to variation are, presumably, those which are most capable of being influenced by physical agencies.

"Thus determined, the parts or measurements may be placed in the following order, according to their degree of variability, beginning with the most variable. The figures give, for each sex and measurement, approximately the total *percentage* of children having a measure-

ment more than 5 per cent. above the average or more than 5 per cent. under the average for their year of age. Roughly, about one-half of each figure corresponds to the downward variation, and one-half to the upward.

		Boys.	Girls.
Grasping power,		75	80
Weight,		67	68
Leg	Girth of calf,	43	50
	Girth of ankle,	45	43
Arm	Girth of forearm,	36	45
	Girth of wrist,	38	37
Trunk	Width of shoulders,	39	38
	Width of hips,	33	38
	Girth of chest,	33	36
	Width of pelvic crests,	30	39

		Boys.	Girls.
Neck,		24	35
Height (standing),		26	27
Height (sitting),		22	25
Head	Height of head,	14	18
	Minimum width of forehead,	17	13
	Maximum width of head,	12	13
	Circumference of head,	7	10
	Maximum length of head,	5	9

"It must, of course, be admitted that the apparent great variability in the grasping power may be due in part to a deficiency in skill in using any test apparatus.

"It is obvious that weight is greatly more variable than height, that the limb measurements are more variable than those of the trunk, and that this is apparent on a comparison, not only of the widths and circumferences, but also of the heights, sitting and standing; and that the least variable are the head measurements. It is also to be noted that width measurements of the skeleton are more variable than length measurements, as may be seen from a comparison of the width of shoulders or pelvic crests with height.

"In any system of bodily measurements for the purpose of ascertaining the effects of physical training, it may, therefore, be proper to include a fair proportion of width and girth measurements.

"With regard to the differences between the sexes, it will be observed that, while the girth of the wrist and ankle is nearly equally variable in the two sexes, the girth of the forearm and calf is distinctly more variable in girls than boys, due, perhaps, to the less general indulgence in exercise by the former. Further, all the trunk measurements, except the width of shoulders, are more variable in girls than boys; and so also, in a marked

degree, is the circumference of the neck. There is scarcely any difference between the sexes in the variability of the height (standing), but there is an appreciably greater variability among girls than boys in the height (sitting). The measurements of the head, except the minimum width of the forehead, are, most of them, distinctly more variable in girls than boys.

"The other measurements, including the weight, are of nearly equal variability in the two sexes.

"As to the effect of age, deviations in weight and height were more numerous at the later than the earlier ages. This was also distinctly true of width of shoulders, in both sexes, and of width of pelvic crests and hips in girls. Variations in chest girth were not materially affected by age in girls, though in boys they were greater at the middle age-group than at the other. Variations in girth of forearm and calf rose markedly in girls at the later ages; they were more steady in boys. It is at the later ages that the difference between boys and girls in the effects of exercise is likely to be most obvious."

6. *Anthropometrical Schedules.*

In the broad sense, Schedules A and B, printed in the Appendix, are anthropometrical schedules; but they are primarily designed from the administrative standpoint. For a schedule designed strictly from the anthropological standpoint, we must refer to "Notes and Queries on Anthropology," already mentioned. In this compact volume will be found full directions for recording every important measurement. At the Southport meeting of the British Association, 1903, a report was presented on "Anthropometric Investigations in Great Britain and Ireland." This report was prepared by a committee of expert anthropologists, and in it are to be found detailed indications both of the desirable measurements and of the methods followed by different anthropologists. The Report by the Royal Commission on Physical Training (Scotland) also contains many suggestions that must be carefully studied by the school anthropometrician. The

ultimate value of all the data accumulated by the various observers, no one can at present foresee; but it is legitimate to suppose that no science of racial or individual progress or deterioration can be founded without the data that are made possible only by these carefully devised and precise measurements. That the medical inspection of schools will afford many opportunities to the anthropologist we have already abundant ground for believing. It is not extravagant to expect that anthropometry will, in time, elaborate a scientific guide for the routine of administration.

MEDICAL INSPECTION—Schedule A.

School Board District,.. Name of School,......................................

I. Address, Occupation of Parents, &c.

Session began,..
Date of Medical Inspection,..
Name of pupil,..
Date of birth,..................day,..................month,..................year.
Place of birth,..
Age—years and months,..
Residence or address,..
Number of rooms in house,..
Number of family and lodgers in house,..
Father's occupation,..
Mother's occupation (if any),..
Does pupil work before school hours?..
Does pupil work after school hours?..
If so, at what occupation?..

II. School Standard or Class.

Position in class,..
Number in class,..
Has position been improving?..
Teacher's opinion of mental capacity—E=excellent, G=good, M=medium, D=dull, Def.=defective,..

III. School Attendance.

Regular or Irregular,..
Number of possible attendances in last school year,..
Actual attendances of pupil in last school year,..
If irregular, causes of irregularity,..
If from illness, name disease,..
Has attendance been improving?..

IV. Physical Exercise.

In School-room—
Forms of systematized exercise,..
Daily duration,..
In Playground—
Forms of exercise, including games,..
Approximate daily duration,..
In Gymnasium—
Forms of exercise,..
Daily duration,..
Is instructor always present?..
What field games, if any?..
Weekly duration,..
Are breathing exercises taught?..

V. Personal Appearance.

Complexion—ruddy (R.), medium (M.), pale (P.),..
Health appearance—good (G.), medium (M.), bad (B.),..
Brightness and alertness—good (G.), medium (M.), bad (B.),..
State of nutrition—stout (S.), medium (M.), thin (T.),..

VI. Cleanliness.

Of Clothing—good (G.), medium (M.), bad (B.),..
Of Body—good (G.), medium (M.), bad (B.),..

VII. Measurements.

Weight (with usual indoor clothing but without boots),......st.......lbs.
Height, standing (without boots),...........centimetres or..........inches.
Girth of Chest (immediately above nipples and over scapulae: arms hanging),.......................
Greatest inspiration,..............centimetres or..............inches.
Greatest expiration,..............centimetres or..............inches.
Average of expiration and inspiration,..........cms. or...... ...ins.

VIII. Teeth.

Cleanliness—good (G.), medium (M.), bad (B.),..
Are they brushed daily?..
Number of permanent teeth visible above gums,..
Regularity—regular (R.), medium (M.), irregular (I.),..
Shape of teeth—good (G.), medium (M.), bad (B.),..
Number of decaying teeth—(1) First set,..........(2) Second set,..........
Number of second set lost,...........upper jaw,...........lower,...........

IX. Eyes.

Colour—dark (D.), medium (M.); Light—(1) all light blues (L.B.); (2) all other light eyes (L.O.),..
Colour perception, normal (N.), defective (D.) (stating colours in which defective),..
Keenness of vision (smallest Snellen's type read at six metres), right,.......................left,....................both,..................
Refraction of eyes—hypermetropia (H.), myopia (M.), astigmatism (A.), right,..
left,..
Is there any squint present?..
Convergent,..
Divergent,..
Other diseases, or any deformity of eyes or eyelids,..
....

X. Ears.

Keenness of hearing—extreme distance at which watch heard, the normal distance being........... (1) right ear,...........feet; (2) left ear,...........................feet. (If speaking test employed, specify extreme distance at which whisper is heard.)
Diseases of ears,..

XI. Nose and Throat.

Sense of smell,.....................Is pupil a mouth-breather?..............
Diseases (*e.g.*, enlarged tonsils, catarrhal tonsilitis, ulceration, pharyngitis, adenoids, or other nasal obstruction, elongation of uvula, enlarged cervical glands),..

XII. Deformities.

(1) Congenital (*e.g.*, harelip, cleft palate, club-foot),..
(2) Acquired (*e.g.*, flat-foot, knock-knee, bowed legs),..

XIII. Diseases.

(1) Skin,..
(2) Glands,..
(3) Bones (*e.g.*, rickets, tubercle, caries, acute inflammation),..
(4) Joints (*e.g.*, rickets, tubercle, caries, stiffness),..
(5) Heart—Regularity,..
Valvular condition,..
Pulse—character,..
(6) Lungs,..
(7) Abdominal organs (*e.g.*, tabes, hernia—umbilical, inguinal, or femoral),..
(8) Other diseases or injuries,..
(9) Vaccination (number, character, and diameter of cicatrices),..
....

XIV. Other observations (*e.g.*, feeding, clothing),..
....
....
....

Signature,..

APPENDIX I.

SCHEDULES FOR RECORDING RESULTS.

Notes on Schedule A.

In Part I., chap. III., will be found a general description of Schedule A. In the special chapters of Part II. are given the methods of examination applicable to all the main physiological systems.

Sections I. to IV. of the Schedule may be filled in by the teacher. The details under these sections remain more or less constant through the child's school history. The spaces for recording results are large enough, however, to permit of second and third entries.

Section V. should be filled in by the medical inspector.

Sections VI. and VII., if not filled in by the medical inspector, should be filled in under his direction.

The remainder of the schedule, with the exception of keenness of vision under Section IX., must be filled in by the medical examiner.

Re-inspections.—It ought not to be necessary to fill in a complete schedule for each child in each year of its school history. The main schedule once filled remains as a permanent record, and becomes a guide to every subsequent examination. If the child leaves one school for another the schedule may be sent with him. If he remains at the same school, the great majority of the items can be, without much labour, kept written up to date. At any re-inspection, only the leading clinical points will demand attention. The eyes will call for no detailed examination within the year. The ear history will be checked in the light of any intercurrent ailments. The height and weight will be taken as a matter of school routine at the beginning of each school year. If the child has been thoroughly examined on admission, the labour of the future examinations should be immensely relieved. The primary schedules should be bound into the school register of medical inspections. Pro-

vision should be made for at least a second and a third inspection.

Notes on Schedule B.

1. *General Scheme of Schedule.*—This schedule, which is a supplement to Schedule A, is intended only for children that are undergoing special physical training. These will, for one reason or another, be selected children. They may be above the average; they may be below; but, in any case, they are subjected to special physical strain. They ought to be medically examined at the beginning of their training. They should be occasionally examined during training. They should again be examined after training. The schedule provides for two special medical examinations; but under "observations," the medical inspector will enter any facts discovered in the various inspections before, after, and during training.

The assumption at the basis of this schedule is that physical training, to give the best results, must be adjusted to physical capacity, and that this can be secured only after careful scrutiny of the vital organs. The medical inspector will have the assistance of the teacher and drill instructor in taking and recording the measurements.

2. *System of Measurements.*—The measurements selected are, with three exceptions (the thigh, ankle, wrist), those recommended by Maclaren. Mr. Cruden ("Physical Culture," p. 312-13) adopts the same system. Mr. Sandow has several additional measurements, all of which are useful and founded on good reasons. Mr. Chesterton, in the Roy. Comm. Phys. Training Scot. Report, adds triceps (right and left).

Maclaren's directions for measurement are carefully devised and well expressed. We quote them here:—

"*System of Measurements.*

"*Height* (without boots).—The position of attention, the heels together, the knees braced back, the chin raised, the head held steady, the shoulders square to the front, the heels, hips, shoulders, and head touching the pillar of the standard.

"*N.B.*—This measurement, when repeated, should always be taken at the same time of the day, and after the same amount of bodily exertion.

No.... ....

MEDICAL INSPECTION—SCHEDULE B.

(FOR CHILDREN UNDERGOING PHYSICAL TRAINING.)

School District,................................ School,..............................

Name,.................................... Age,.................................

Sex,.................................. Standard,...........................

General Medical Examination—Schedule A..............................19.....

Special Medical Examination :—

Before Training.

Heart,....................................

Pulse,....................................

Lungs,....................................

Kidneys,..................................

Other organs,............................

After Training.

Heart,..............................

Pulse,..............................

Lungs,..............................

Kidneys,............................

Other organs,.......................

Description of Exercises :—

Class-room,..

Drill-room or Gymnasium,...

Games,...

Instructors,..

TABLE OF MEASUREMENTS.

Dates.	Began ......19....	Re-measured, ...19....	Re-measured, ...19....	Re-measured, ...19....	Increase.	Decrease.
Height, -						
Weight, -						
Chest (max.), -						
Chest (min.), -						
Chest (count 10),						
Wrist, - -						
Forearm, -						
Upper arm, - -						
Calf, - -						
Ankle, - -						
Dynamo-meter,						

Observations,..

....

....

Medical Inspector.

"*Weight.*—In working costumes, *i.e.*, in light shoes, flannel trousers, flannel shirt or jersey.

"*N.B.*—This measurement, when repeated, should always be taken at the same time of the day, and with reference to any circumstance which would affect its accuracy.

"*Chest.*—Over the jersey or naked breast. The position of attention, but with the arms horizontally extended, the palms of the hands held upwards and open, the finger straight. The tape should be passed around the chest in the line of the nipple.

"*N.B.*—Care must be taken that the chest is not inflated beyond its usual expansion during ordinary breathing. Where a single measurement is taken the above line is the best, as gauging approximately at once the muscular and respiratory capacity; but when the latter quality is of primary importance (as in rowing) a second measurement should be taken lower down the chest, the tape being passed over the ninth rib.

"In measuring recruits in the British army, the man stands erect, with the arms hanging loosely by the side. The lower edge of the tape should touch the nipple. The man is required to count ten slowly during the operation, to prevent him from keeping his lungs over-inflated.

"*Forearm* (skin measurement).—The arm extended as in the preceding measurement, but with the hand tightly closed, the tape to be passed around the thickest part of the arm, and its girth at that point reckoned.

"*N.B.*—With men who have taken little exercise this line will always be found near the elbow joint, but as the limb becomes developed, and the numerous muscles of the forearm acquire bulk and power from exercise, the greatest girth will be found from 2 to 3 inches below it. Unless this circumstance be kept in view the actual increase will not be perceived.

"*Upper arm* (skin measurement).—The hand closed, the arm bent at the elbow, and the hand brought down towards the shoulder. This should be slowly and gradually done, bending the joints of the fingers, clenching the fist, and bringing the fore-arm down upon the upper arm, the tape to be passed in a straight line around the thickest part of the arm.

"*N.B.*—When the whole arm is fully developed, the difference in size between the fore and upper arm in an adult of medium stature will be about 2 inches, and it will almost invariably be found that when the upper arm is feeble the upper region of the chest will be feeble also. With a chest of 40 inches the arm would probably be 12 inches and 14 inches.

"*Calf* (skin measurement).—The limb to be held stiff and straight, the heel raised from the ground, the toes pressed strongly down, and the knee braced back. The tape is to be passed around the thickest part of the calf; and as the position of this line will somewhat vary with different men, and with the same limb in different stages of development, one or two points should be tried and that which shows the greatest girth selected." *

3. *Measurement of Chest.*—Maclaren's measurement of the chest is sufficient for his purpose. But it is important to encourage correct breathing. To secure this, the expansion of the chest ought to be ascertained. This is difficult in young children, in whom breathing is mainly diaphragmatic. It is not difficult in the older children. The schedule contains three chest measurements—maximum, that is, the measurement on deepest inspiration; minimum, that is, on deepest expiration; "counting ten," that is, average of ordinary inspiration and expiration. When deepest inspiration and expiration cannot be properly secured, the "counting ten" measurement should be recorded; this gives a fair average. About 1 cm. may be allowed for clothing, if the measurement is over a jersey or shirt.

Mr. Rippon Seymour ("Physical Training," p. 124) records chest (maximum), chest (normal). Mr. Sandow records chest (expanded) and chest (contracted). This is the same as the maximum and minimum of the schedule.

All systems of training should secure good chest expansion.

4. *Time of taking Measurements.*—The schedule provides for measurement at four periods—the first, when training begins; the other three, at such periods thereafter as may be considered advisable. If a course extends through the school year, quarterly measurements will be sufficient. If it extends only over six months, the periods of measurement may be reduced accordingly. In all cases, at least two measurements should be taken—one at the beginning, and one at the end of training.

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* "Physical Education." By Frederick Treves, F.R.C.S., in Stevenson and Murphy's "Hygiene and Public Health," vol. i., p. 551.

APPENDIX II.

Medical Inspection of Alloway School.

Through the kindness of John B. Fergusson, Esq. of Balgarth, Ayrshire, we are able to give the results of an inspection of a rural school—the Alloway School. The examination was conducted by Surgeon Lt.-Col. W. J. Naismith, D.S.O. The tables were prepared by Mr. Fergusson, who was a member of the Physical Training Commission (Scotland).

The average attendance at this school was, at the time of examination, 187. Of these, sixty were selected—ten of each sex in each age-group. The examination was conducted on the same lines as the Edinburgh and Aberdeen examinations, and the results tabulated in a form to admit of detailed comparison. We reproduce here, but not in the same tabulated form, the principal quantities.

The Alloway School was erected in 1896. It is, therefore, of modern construction. The ventilation is by fires and windows. The heating is by open fires and hot water pipes. The cubic space per pupil is 181 cubic feet. The playground area per pupil is 17 square yards. The physical training at this school includes gymnastics, drill, free gymnastics and games. The school is a rural school. The children attending it thus have the advantage of pure country air. Presumably, they were mainly drawn from the agricultural classes. They may be accepted as typical country children.

Of the children examined, 1·66 per cent. lived in houses of one room; 8·33 per cent. in houses of two rooms; 31·66 per cent. in houses of three rooms; 23·33 per cent. in houses of four rooms; 25 per cent. in houses of five rooms and upwards. It is thus seen that approximately 10 per cent. lived in houses of one or two rooms; approximately 90 per cent. lived in houses of three rooms and upwards. So far as classification by house-room is concerned, the Alloway School children examined must thus be placed on much the same level as the best schools examined in Aberdeen and Edinburgh. In the four Edinburgh Schools, the percentages

living in one-roomed and two-roomed houses taken together were approximately 45, 42, 76, and 13. For further details regarding rooms we must refer to the tables of the Royal Commission's Report.

Classed aeeording to Mental Capacity, 51·66 per cent. were good; 48·33 per eent. were medium. None was reekoned dull or defective.

In Complexion, 5 per cent. were pale; 55 per cent. medium; 40 per eent. ruddy.

In Health Appcarance, 95 per eent. were good; 5 per eent. medium; none bad.

In Nutrition, as tested by inspeetion, 13·33 per eent. were stout; 83·33 per cent. medium; 3·33 per eent. thin.

In Brightness and Alertness, 70 per eent. were good; 30 per eent. medium; none bad.

In Carriage and General Balanee, 90 per eent. were good; 10 per eent. were medium; none bad.

In Cleanliness of Clothing, 91·66 per eent. were good; 8·33 per cent. medium; none bad. In cleanliness of body, 95 per cent. were good; 5 per eent. were medium; none bad.

In this part of the examination, as has been repeatedly remarked, the personal equation of the examiner eounts for a great deal; but the results in this ease appear to be borne out by the detailed measurements of height and weight.

We here give in tabular form the Weight, Height, and some other measurements.

Age - -	6 to 9.		9 to 12.		12 to 15.	
	Males.	Females.	Males.	Females.	Males.	Females.
Weight (in lbs.),	53·80	50·40	69·80	64·90	76·50	79·75
Height (cms.),	123·50	119·40	137·25	134·20	142·0	145·05
Neck (min. cir.),	26·60	25·30	27.75	26·70	28·50	27·80
Chest, - -	62·90	58·65	68·45	64·05	70·05	69·80
Shoulders, -	29·40	28·40	32·50	30·95	34·25	34·10
Forearm, -	18·05	17·45	19·50	18·65	20·20	19·85
Calf, - -	24·15	23·90	27·20	26·85	27·60	28·20
Ankle, - -	16·40	16·0	18·30	17·65	18·50	18·80

In the examination of the Teeth, it was found that—

(*a*) In Cleanliness, 20 per eent. were good; 6·66 per eent. medium; 3·33 per cent. bad;

(*b*) 5 per cent. brushed the teeth daily;

(*c*) 1·66 per cent. showed Delayed Development;

(*d*) As to Regularity, 45 per cent. were found regular; 40 per cent. medium; 15 per cent. irregular;

(e) In Shape, 40 per cent. were found good; 56 per cent. medium; 3·33 per cent. bad;

(f) As to Decay of Teeth, first set, 86·66 per cent. showed decay—the average number of decayed teeth in those cases being 2·10; second set, 73·33 per cent. showed decay, the average number of decayed teeth in those cases being 1·62. Of teeth lost of the second set, the average number per child was 1·70. In the chapter on the Examination of the Teeth, the figures for Edinburgh and Aberdeen are given in detail.

In the Eye tables, no indication is given as to whether the refraction of the eyes was tested by retinoscopy. In Vision, presumably as tested by the distance reading test, 88·33 per cent. were found normal; 11·66 per cent. were found defective. The facts for Aberdeen and Edinburgh are given in the chapter on the examination of the eye. There were no diseases of the eyes or eyelids.

In Hearing, 98·33 per cent. were found normal; 1·66 per cent. were found defective. There is no indication as to whether the ears were examined with the speculum. There were no diseases of the ear discovered.

As to other Diseases, 18·33 per cent. showed enlarged tonsils only; 1·40 per cent. showed heart affection. The total of all diseases amounted to 19·73 per cent. No deformities were discovered.

At this school, the children, during the winter, are provided with a mid-day meal. The increased working capacity is found to be very great.

APPENDIX III.

Mr. A. J. Pressland has brought to our notice some details of the school report of Zürich Town for the year 1902. We translate some important figures. The school authority of Zürich makes a detailed medical inspection of all children of school age. Those unfit to begin school are referred back to their homes, or to hospitals, or to special schools suited to their physical and mental condition.

"*Rejection of New Scholars.*—On the 1st of May, 1902, the following had reached the legal age for attending school:—

District.	Boys.	Girls.	Total.
I.	182	160	342
II.	130	114	244
III.	728	750	1478
IV.	194	166	360
V.	286	284	570
	1520	1474	2994

"The following were shown to be still unfit for admission to school:—

District.	Boys.	Girls.	Total.
I.	7	7	14 or 4·5 per cent.
II.	7	1	8 or 3·5 ,,
III.	32	38	70 or 4·8 ,,
IV.	9	10	19 or 5·3 ,,
V.	14	17	31 or 5·4 ,,
	69	73	142 or 4·7 per cent.

"The causes of rejection were as follows:—

(*a*) *Mentally Deficient.*

	Boys.	Girls.	Total.
Imbeciles, - - - - - -	—	1	1
Feeble-minded, - - - -	8	2	10
Mentally backward, - - -	4	4	8

(*b*) *Bodily Defects.*

	Boys.	Girls.	Total.
Defects of organs of hearing, - -	5	8	13
,, ,, speech, - -	—	—	—
,, ,, sight, - -	—	—	—
Nerve diseases, - - - -	1	—	1
Retarded or defective growth, -	51	58	109
Total defects, - - -	69	73	142"

This report contains many valuable facts both medical and non-medical. The above figures are quoted to show the importance of eliminating at the outset of school life all those in any way incapacitated for the best educational results. This medical classification on admission will save much medical inspection at the later stages.

APPENDIX IV.

The Closing of Schools for Infectious Disease.

The following circular, issued by the English Local Government Board, contains a large number of practical points bearing

on the closure of schools. In form the circular applies only to schools in England, but in substance it is equally applicable to all schools. This circular contains the answer to many questions that continually recur in school and public health administration.

MEMORANDUM, prepared in the Medical Department, on the Circumstances under which the Closing of Public Elementary Schools or the Exclusion therefrom of particular Children may be required in order to prevent the Spread of Disease.

Objects of Memorandum.

1. It is attempted in these notes to bring together the information in the possession of the Local Government Board, derived from the reports of the Board's own medical inspectors and of local medical officers of health, respecting school-closure and exclusion from school as precautions against infection, with a view to indicate the best means of preventing the spread of disease by school children among their fellows, while avoiding any unnecessary interruption of the work of education.

Regulations of Board of Education.

2. In the Provisional Code of Regulations issued by the Board of Education in 1903, the following article (Art. 88) prescribes, as one of the general conditions required to be fulfilled by a public elementary school in order to obtain an annual Parliamentary grant, that—

"If the sanitary authority of the district in which the school is situated, or any two members thereof acting on the advice of the medical officer of health, require either the closure of the school or the exclusion of certain children for a specified time, with a view to preventing the spread of disease or any danger to health likely to arise from the condition of the school, such requirement must at once be complied with, but after compliance appeal may be made to the Board (of Education) if the requirement is considered unreasonable."

Article 83 (a) prescribes that "if a school has been closed during the year under medical authority, or for any unavoidable cause, a corresponding reduction is made from the number of meetings" (400 a year) required.

(The "medical authority" referred to in this article is not necessarily that of the medical officer of health.)

Epidemic Grant Withdrawn.

Article 101, which provided that where the Board of Education were satisfied that by reason of a notice of the sanitary authority under Article 88, or any provision of an Act of Parliament, requiring the exclusion of certain children, or by reason of the exclusion under medical advice of children from infected houses, the average attendance had been seriously diminished, and that consequently a loss of annual grant would, but for this article, be incurred, the Board should have power to make a special grant not exceeding the amount of such loss in addition to the ordinary grant, has ceased to operate since 31st March, 1903.

Diseases principally Requiring Action.

3. The disease for the prevention of which school closure, or the exclusion of particular children, will be required are principally those which spread by infection directly from person to person, such as diphtheria, scarlet fever, measles, whooping-cough, epidemic influenza, small-pox, and rötheln. More rarely, the same questions arise in connection with enteric fever and diarrhœal diseases, which spread not so much by direct infection from person to person as indirectly through the agency of local conditions, such as infected school privies.

4. It will be seen that Article 88, quoted above, confers upon sanitary authorities an alternative power with respect to public elementary schools—

(A.) To cause particular scholars to be for a specified time excluded from attendance, or

(B.) To require the school to be closed for a specified time.

Exclusion of Scholars.

5. *A. First, as to Exclusion from School of Particular Scholars.*—Here it will be convenient to consider the circumstances under which the requirements of the public health will be satisfied by the less severe measure of the exclusion from school of particular children.

(*a*) It may be laid down as a universal principle that all children suffering from any dangerous infectious disorder (*i.e.*, of a nature dangerous to some of the persons attacked by it, however mild in other cases) should be excluded from school until there is reason to believe that they have ceased to be in

an infectious condition (*see* section 126 of the Public Health Act, 1875).

From Infected Houses.

(*b*) Furthermore, as it is rarely possible to provide effectual separation of the sick from the healthy within the homes of children of the class attending public elementary schools, it must commonly be necessary that all children of an infected household should be excluded from school; first, because otherwise such children might attend school while suffering from the disease in a latent form, or at an unrecognised stage, and secondly, because it is known that infection may attach itself to, and be conveyed by, the clothes of a person living in an infected atmosphere, even though the person himself remain unaffected. The same considerations will sometimes make it desirable to prohibit the attendance at school of all children from a particular street or hamlet.

From Particular Localities.

In the case of infectious diseases involving little or no danger to life, such as mumps or skin diseases, school interests may be more particularly considered. In such case, however, it will usually be well for the medical officer of health to advise the managers to prohibit the attendance of every child while in an infectious state.

Closing of Schools—When to be Required.

6. *B. Secondly, as to the Closing of Schools.*—This, by more seriously interfering with the educational work of a district, is a much more grave step for a sanitary authority to take than to direct the exclusion of particular scholars. It is a measure that seldom ought to be enforced, except under circumstances involving imminent risk of an epidemic, nor even then as a matter of routine nor unless there be a clear prospect of preventing the propagation of disease, such as could not be looked for from less comprehensive action.

The mere fact that in an epidemic many of the sufferers are school children does not necessarily show that the disease was caught at school; but the school may with probability be regarded as spreading infection if in a large majority of households attacked the first case be a child attending school; and with still greater probability if a

number of children living at a distance from one another, and with no circumstances in common, except that they attend the same school, should be simultaneously attacked, and if it can be ascertained that a child or teacher in an infectious state has actually been attending the school.

Duty of Medical Officer of Health when Infectious Disease Occurs.

7. By Article 18 (6) of the Board's Order of 23rd March, 1891, the medical officer of health on the occasion of an outbreak of dangerous infectious disease is to advise the persons competent to act as to the measures to be taken to prevent the extension of the disease. If, therefore, he finds that the children of infected households are attending school, he should send notice of the fact to the schoolmaster, and give such advice as appears to him to be necessary with regard to the exclusion of the children from school, and as to the time for which such exclusion should continue.

Where the number of children to be excluded is small, and the schoolmaster acts on the advice of the medical officer of health, it may not be necessary to take formal action under Article 88 of the code; but where the number of children whom it is desirable to exclude from school is such as is likely seriously to diminish the average attendance, or where the advice of the medical officer of health is not followed, and there is danger of the disease spreading by means of the school, notice for the exclusion of the children in question should be made in accordance with the requirements of Article 88.

Aid which Schoolmasters and Others can give.

The attention of school attendance officers and of schoolmasters should also be drawn to the following considerations. Frequently they themselves will obtain the earliest information of the occurrence of infectious disease among scholars, and it is most desirable that such officer or master should without delay communicate the facts to the medical officer of health. Absence of any child from school on the plea that it is suffering under one of the before-mentioned diseases, and absence of several children of one family from school at the same time, no matter what name be given to the complaint that keeps them at home, should be reported to the health officer. In practice it has been

found that this notification of absentees has materially aided the local health officer in taking measures for the suppression of infectious disease, to the advantage alike of the district and of the school. Furthermore, schoolmasters may properly be asked to take note, especially when an epidemic threatens or is present, of symptoms occurring in any of their scholars that may indicate the commencement of the disease, febrile in nature. Besides heat of skin, such symptoms are shivering, headache, and languor, especially if commencing suddenly, vomiting, rashes on the skin, and sore throat. When scarlet fever or diphtheria is about, every trace of sore throat should be looked upon as suspicious. In any case where such symptoms are observed, the safest course will be to exclude the child from school until assurance can be had that it may attend school without harm to itself or danger to other scholars.

Exclusion of Particular Scholars; Duration of.

8. As regards duration of exclusion from school of particular children, the time to be specified will vary in different diseases and different cases, and in this matter the sanitary authority will doubtless be guided by the advice of their medical officer of health.

Considerations which should Determine Period.

Medical officers of health, having to specify a time during which any scholars are to be excluded from attendance at any school, should have regard as far as practicable to the circumstances of the particular scholars suffering from infectious disease or living in infected households. Not only the nature of the infection and the length of illness, but the environments of the individual as affecting the retention of infection will deserve consideration. The period of exclusion, for example, will need to be different according to the conditions of a patient's lodgment, according to the sufficiency of the separation that can be effected between a patient and excluded scholars, and according to the opportunities of effectual disinfection that can be afforded to the household. Thus a hard and fast rule, such as has been laid down in some districts where scarlatina has been present, that no child shall go to school from an infected house for three months after the disease has begun

in that house, is not to be commended. It is indeed possible that under the circumstances of a particular household, a child convalescent from scarlatina or living in the same house with convalescents should not in the interests of other children be permitted to return to school until after so long a period as this; but the same ought not to be assumed of all households in the district that may be invaded by scarlatina.

Period of Exclusion may be Prolonged by New Notice.

The better plan would be for the sanitary authority to secure, during a shorter period, the exclusion of individual sick persons and their housemates from school; and when that period is about to expire to cause fresh inquiry to be made as to the expediency of further exclusion, and, if found requisite in particular cases, to cause fresh notice to be given to the school managers.

Whether Exclusion or School Closure to be Preferred.

9. In deciding whether an outbreak of infectious disease among children of school age may be best combated by closing the school, or whether it will suffice to exclude the children of infected households, the two most important points to be considered are—

(*a*) The completeness and promptness of the information received by the officers of the sanitary authority respecting the occurrence of infectious cases.

(*b*) The opportunities which exist for intercourse between the children of different households elsewhere than at school.

When Exclusion System to be Preferred.

10. (*a*) The more prompt and full the knowledge of cases of infectious disease that the sanitary authority are able to obtain, the better will be the prospect of checking such disease by keeping away from school the children of infected households, and the less will be the necessity for closing schools.* If the cases be few in number, and their origin known, the exclusion from school of the children of infected households will probably suffice, but this measure will fail where there are many undis-

* Information obtainable under the Infectious Disease (Notification) Act, 1889, will be specially useful in this direction.

covered and unrecognised cases, or where the known centres of infection are very numerous.

When Total Closure of School Preferable.

Commonly, the failure of carefully considered measures of exclusion to stay the spread of an epidemic which shows a special incidence upon school children, may be regarded as pointing to the continued attendance at school of children with the prevalent disease in a mild or unrecognised form, and a strong case will appear for the closing of schools.

If by reason of the absence or exclusion of a considerable number of children the attendance at a school be greatly reduced, it may be found better to close it altogether. This is especially apt to occur in the case of epidemics of measles, a disease which is very infectious in the early stages, before the characteristic rash has appeared, and while the symptoms resemble those of a common cold.

Closure of Schools in Rural Districts and in Populous Localities.

11. (*b*) The second material consideration, in deciding as to the desirability of closing schools during the prevalence of infectious disease, is the amount of opportunity for intercommunication between the members of different households elsewhere than at school. In sparsely populated rural districts, where the children of different households, or of separate hamlets rarely meet except at, or on their way to, the village school, the closing of the school is likely to be effectual in checking the spread of disease. It is less likely to be useful in a town or compact village (particularly where houses are sub-let and yards are in common), where the children of different households, when not at school, spend their time in playing together, and often run in and out of each other's houses. But it must be remembered that children when at play out of doors are brought into much less close association with each other than when in school.

In rural districts, where epidemic diseases are less frequently prevalent, school closing may be required as an exceptional measure to meet an exceptional state of things. As regards more populous places, it must not be forgotten, that if schools were to be closed whenever an infectious disease was prevalent, there are many places where schools would hardly ever be open.

For Purposes of Disinfection, &c.

It will sometimes be necessary to close a school for a day or two to allow of the rectification of sanitary defects of a nature to extend disease, or in order that the school may be disinfected or purified. It has happened that infectious sickness in the master's family has forbidden the attendance of scholars. These more temporary and occasional closures of schools are contemplated in the Education Code, and are to be regarded as having a real importance of their own.

Where Many Schools Exist.

12. In places where there are several public elementary schools, if an outbreak of infectious disease be confined to the scholars of one particular school, it may be sufficient to close that school only. But where different schools have all appeared to aid in the spread of disease (though perhaps to an unequal extent) the sanitary authority may consider it advisable that all should be closed lest children in an infectious state who previously attended the schools that are closed, should be sent to others that might remain open.

Sunday and Private Schools.

It must be remembered that sanitary authorities have no power in respect of Sunday Schools, or other private schools: except in so far as these may contravene section 91 (5), section 126, or other provision of the Public Health Act, 1875; but it will often be expedient to invite the co-operation of managers of such schools in efforts for securing the public health. Experience shows that they are usually ready to defer to the representations of the authority responsible for the public health of the district.

Duty of Medical Officer of Health as to Reporting.

13. The medical officer of health has not power to order the closing of a school; his function in this respect is advisory only. Reports of medical officers of health to sanitary authorities, advising the closure of a school or schools in any district, are to be treated as "special" reports within the meaning of the General Order of the Local Government Board of 23rd March, 1891, and copies of them are required by Art. 18 (15) and (16)

of that Order to be sent by the Board, and to the County Council. These reports should state the grounds upon which the medical officer of health advocates the closure of the school or schools in preference to the exclusion of particular scholars.

Notices Requiring Closure of Schools.

14. All notices of the sanitary authority for the closing of public elementary schools should be addressed in writing to the managers, and should state the grounds on which the closing is deemed necessary.

Notices to Specify Definite Periods.

All such notices shall specify a definite time during which the school is to remain closed; this should be as short a period as can be regarded as sufficing on sanitary grounds, since a second notice may be given before the expiration of the first, if it should be found necessary to postpone the re-opening of a school. The managers of schools, after complying with the requirements of the sanitary authority, have the right of appeal to the Board of Education, if they consider any notice to be unreasonable.

May, 1903. W. H. POWER.

FOR FURTHER STUDY.

1. REPORT OF THE ROYAL COMMISSION ON PHYSICAL TRAINING (SCOTLAND). Volumes I. and II. London: Eyre & Spottiswoode, East Harding Street, Fleet Street; Oliver & Boyd, Edinburgh.

2. ARTICLE "CROISSANCE" IN "DICTIONNAIRE DE PHYSIOLOGIE." Par Charles Richet. Paris: Felix Ancan.

3. ANTHROPOLOGY. By Dr. Paul Topinard. London: Chapman & Hall.

4. ANTHROPOMÉTRIE OU MESURE DES DIFFÉRENTES FACULTÉS DE L'HOMME. Par Ad. Quetelet. Bruxelles: C. Muquardt, Place et Rue Royale. 1870.

5. NOTES AND QUERIES ON ANTHROPOLOGY. Edited for the British Association for the Advancement of Science by John George Garson, M.D., and Charles Hercules Read, F.S.A. 3rd edition. London: The Anthropological Institute, 3 Hanover Square, W. 1899.

6. DATEN UND TABELLEN. Dr. Hermann Vierordt. Jena: Verlag Von Gustav Fischer. 1893.

7. THE PREVENTION OF DISEASE. Translated from the German. With an Introduction by H. Timbrell Bulstrode, M.A., M.D. (Cantab), &c. Westminster: Archibald Constable & Co., Ltd., 2 Whitehall Gardens. 1902.

8. THE HYGIENE DISEASES AND MORTALITY OF OCCUPATIONS. J. T. Arlidge, M.D., A.B. (Lond.), F.R.C.P. (Lond.), &c. London: Percival & Co. 1892.

9. DANGEROUS TRADES: The Historical, Social, and Legal Aspects of Industrial Occupations as Affecting Health. By a number of Experts. Edited by Thomas Oliver, M.A., M.D., F.R.C.P. London: John Murray, Albemarle Street. 1902.

10. A SYSTEM OF MEDICINE. Edited by Thomas Clifford Allbutt, M.A., M.D., LL.D., &c. Article by Dr. Hermann Weber

and Dr. Michael G. Foster on "Climate in the Treatment of Disease." London: Macmillan & Co.

11. Text-Book of the Eruptive and Continued Fevers. By John William Moore, B.A., M.D., &c. London: Baillière, Tindall & Cox.

12. The Diseases of Children's Teeth: their Prevention and Treatment. By R. Denison Pedley, M.R.C.S., L.D.S. (Eng.), F.R.C.S. (Edin.). London: Segg & Co., 289 and 291 Regent Street.

13. Poverty: A Study of Town Life. By B. Seebohm Rowntree. London: Macmillan & Co.

14. Annual Reports of the Central School Board of the Town of Zurich. Ulrich & Co., Zürich.

15. Annual Reports by Medical Officer of London School Board. Offices of the Board, Victoria Embankment, or, King & Son, 2 and 4 Great Smith Street.

16. Report on Prison Dietary. Bluebook. By Dr. Crauford Dunlop, F.R.C.P.E.

17. The Food Requirements of Varying Labour. *The Scottish Medical and Surgical Journal.* By Dr. Crauford Dunlop. May, 1901.

18. Some Effects of Certain Diets upon Excretion by the Kidneys and upon the Blood. By R. S. Aitchison, M.D., F.R.C.P.E. Printed for the author by Turnbull & Spears, Edinburgh. 1896.

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Printed by Wm. Hodge & Co., Edinburgh and Glasgow.

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